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JAN. 1965
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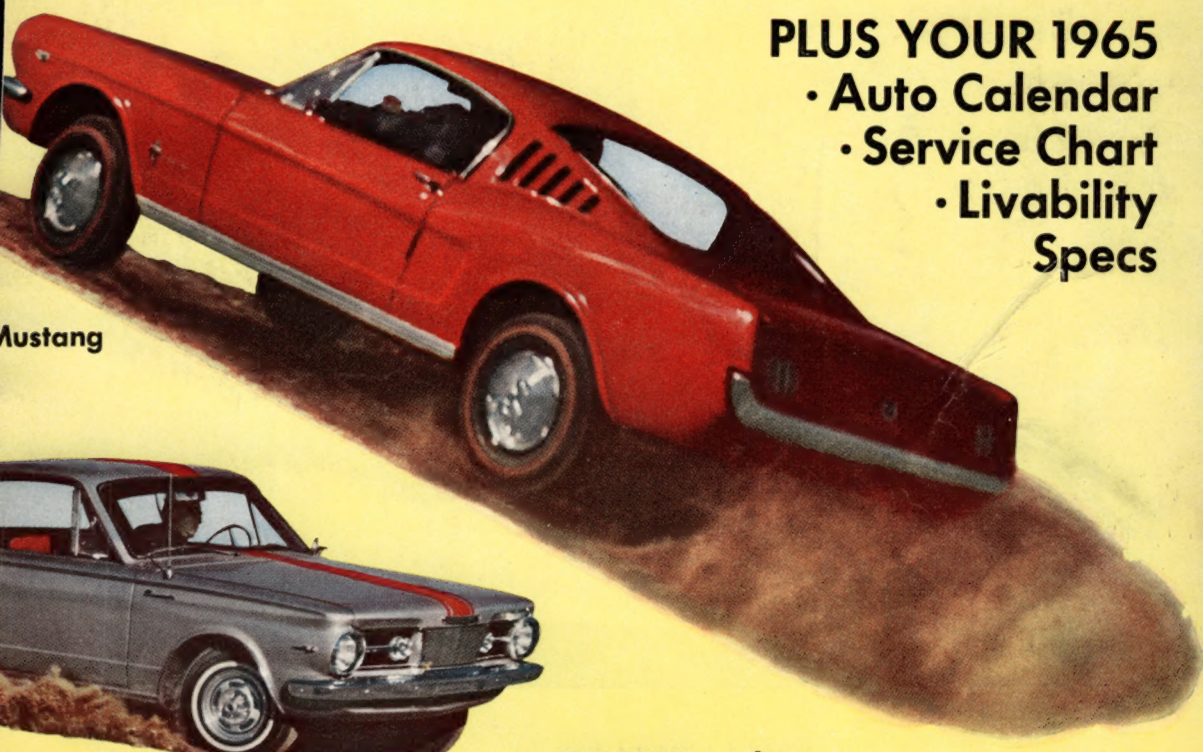
- Auto Calendar
- Service Chart
- Livability Specs



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Plymouth Barracuda

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The Beer that made Milwaukee Famous
. . . simply because it tastes so good.

The 1965 Ford rides quieter than a Rolls-Royce!

The world's leading acoustical experts, Bolt, Beranek and Newman, Inc., made the tests. The authoritative U.S. Auto Club certified the results: at 20 mph . . . at 40 mph . . . at 60 mph.

We knew our 1965 Fords were quiet. So did automotive experts who previewed them. In fact, so many automotive editors mentioned Ford quietness, we wondered if a quieter car existed. To find out, we took on Rolls-Royce, the best built, most luxurious car we could think of.

We called in Bolt, Beranek and Newman, Inc., of Cambridge, Mass., famed acoustical consultants to government and industry. We bought two brand-new Rolls-Royce Silver Cloud III's and we tested them against our own new Fords at 20 miles per hour, at 40, and at 60. All cars were tuned to manufacturer's specifications.

One of the new $16,655 Rolls-Royce Silver Cloud III sedans tested.

Our 1965 Fords proved quieter than the Rolls-Royces. USAC certified the results.

Sound is measured in decibels. Normal human speech is about 60 decibels. At forty miles per hour, a '65 Ford is 5.5 decibels quieter than a Rolls-Royce. At 60 miles per hour, the Ford is 2.8 decibels quieter. This is a slight difference, to be sure . . . but amazing when you consider that the Rolls is a hand-built, bench-tuned, $16,655 automobile—and the Ford is built on an assembly line to sell for many thousands less.

Of course, we aren't claiming you'll get a Rolls-Royce for the price of a Ford. The differences are many and obvious. But what you will get in our '65 Ford is an exceptionally smooth ride that comes from a new suspension, new frame, and a new body mounted on the frame at computer-determined places where there is a minimum of vibration. You get a car that rides, as we have proved, quieter than a Rolls-Royce. And in this 1965 Ford you will get solid quality quite unlike anything you have ever known in our price range.

Drive the quiet new Ford before you buy any new car this year.

SOUND LEVEL (All readings in decibels)

MPH	FORD	ROLLS ROYCE	FORD QUIETER BY
20 mph	67.4	72.3	4.9
40 mph	75.9	81.4	5.5
60 mph	82.6	85.4	2.8

TEST CONDITIONS: Dry, level, moderately smooth concrete divided highway; light, quartering wind. All cars operated at steady 20-, 40- and 60-mph speeds with all windows and vents closed. CARS TESTED: Two Rolls-Royce Silver Cloud III sedans, V-8 with automatic transmission, list price in New York $16,655 each. Three 1965 Fords, each with 289-cubic-inch V-8 engine and Cruise-O-Matic: Galaxie 500 LTD, Galaxie 500/XL and Galaxie 500 4-Door Sedan.

Certified by UNITED STATES AUTO CLUB

Best year yet to go Ford!
Test Drive Total Performance '65

FORD

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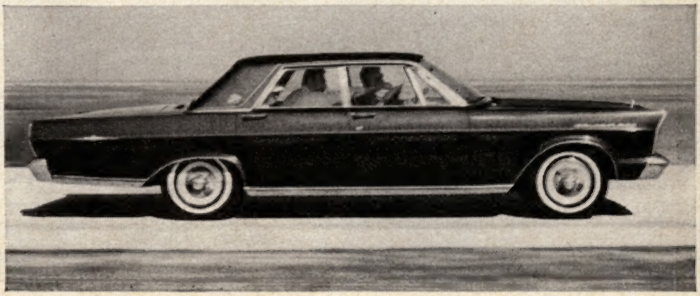
PRODUCTS OF Ford MOTOR COMPANY

Total Performance 1965 Ford Galaxie 500 LTD 4-Door Hardtop



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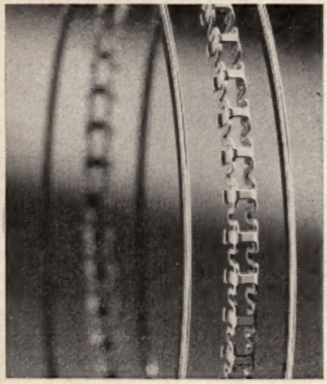
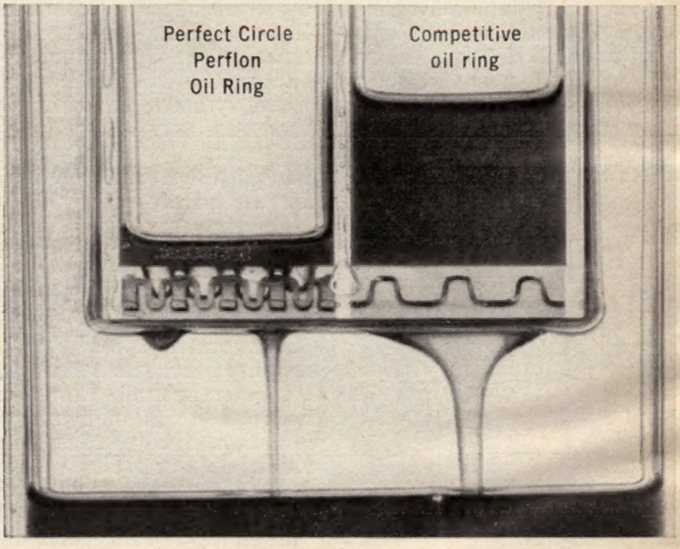
The Teflon coating, plus PC's wide-span slot design, gives you an oil ring that eliminates the clogging and sticking problem.

Other features of the Perflon ring include (1) chrome-plated, tempered steel rails and (2) proper side seal and face seal for effective oil control.





The un-retouched photo above shows a Perflon ring in action. Using equal amounts of the same weight oil, the Perflon ring lets oil drain as much as 160% faster than competitive brands.

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Looking for a fishing motor that tucks in a car trunk, carries like a suitcase, goes like the wind and thrives on a 50 to 1 gas-oil diet?

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NEXT MONTH: ***The house*** that heats itself and its indoor swimming pool complete with sunshine and how it saves money doing it. Also in February PM: What owners think of the new Fords and Chevys; the story of the robot we'll send to the moon; some new electronic tricks to make flying safer; silencing squeaky floors and mending books.

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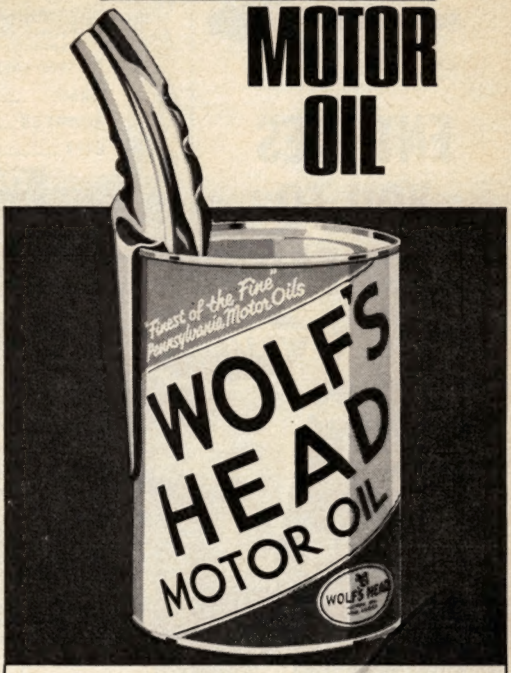

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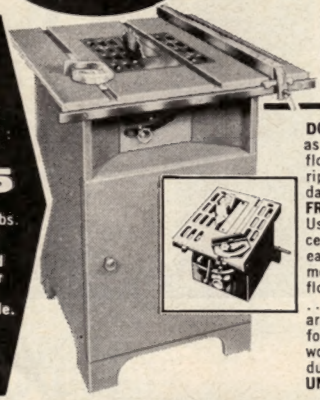

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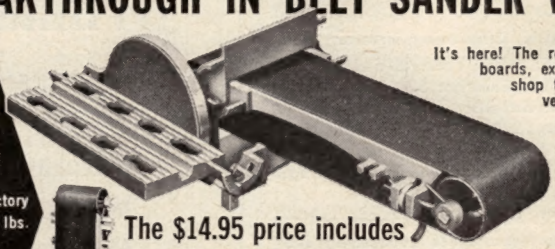

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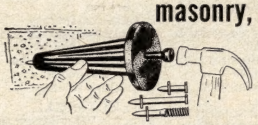

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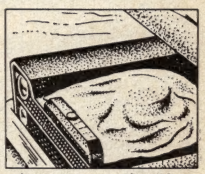

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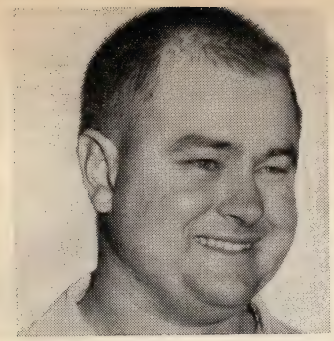

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Over the Editor's Desk

Everybody Painted

My son and I built the *Waterbug* (page 140, May 1964 *PM*), and the entire family helped paint it.

It has been used extensively in San Diego's Mission Bay and always draws

quite a crowd of observers. The boat has proved seaworthy with up to a 100-pound load, and has furnished many hours of enjoyment for the kids.

Thanks to *PM* and the author for such an interesting project and for the clear drawings and text.

Chula Vista, Calif. DR. EDWARD A. KEMLER

Sidewalk Success

My sons—as well as myself—are very proud of the *Sidewalk Classic* (page 146, November 1963 *PM*) I built, since this is

my first attempt at building anything of this sort. It took me about six weeks of spare time. Thanks for a fine set of plans.

Bristol, Tenn. ERNEST PHIPPS

What's Up?

In the article on kit aircraft (*Sidelights on Aviation*, page 30, November *PM*) is the statement that flying a kit plane without FAA approval would be "like driving an automobile that didn't have a license."

This is not an apt comparison because an automobile does not have to have any sort of license to prove its suitability for safe use and, indeed, does not need a license at all unless driven on tax supported roads.

Carbondale, Ill. R. G. SCHIPF

The author, PM's aviation editor Kevin Brown, defers to the auto experts on legalities of road traffic—but repeats his point: It takes government approval to use airspace (except for birds).

Still Building

I recently built the *Fat-Tire Scooter* (page 151, April 1963 *PM*).

I made some mistakes; I got the machine shorter than it should have been and also too tall. I cut down the height by cutting four inches off the fork and off the rear of

the frame. The length I left since it just made the machine more compact. The engine is six horsepower (really too big), and I used a go-cart clutch.

The machine cost about $150 and at least 100 hours time.

I'd like to add that as a boy I made many things from your magazines and books. Now I'm 57—and still at it.

Lexington, Ky. CARL R. GREATHOUSE

Breathing Shingles

Your article, *All About House Paints* (page 121, July *PM*), is very interesting.

There's one thing you didn't mention. I've been told that shingles are porous, and, if stained or painted with shingle paint, remain porous, permitting moisture from within to escape. Thus, they never create a blistering problem. Is this right?

Worcester, Mass. H. M. LANE

(Please turn to page 12)

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Over the Editor's Desk

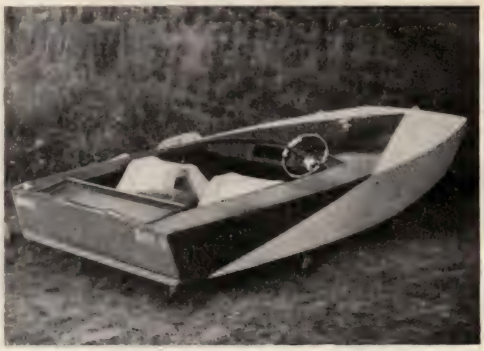
(Continued from page 10)

Correct, reports Author Steven Howard. Shingles painted with a "breathing" paint—whether oil base, alkyd, latex, or with stain—do remain porous and do breathe, thereby permitting moisture to escape. Other paints seal up the pores, and in time could cause problems with the paint.

First-Class Hydro Dynamic

Many thanks for the plans for the fine boat, *Hydro Dynamic* (page 144, March 1963 *PM*).

I used all first-class lumber plus $55 worth of brass screws and completely



fiberglassed every inch of it from top to bottom. With all hardware except the windshield, I built it for $260. That's a small investment for a maintenance-free hull that promises many years of fun.

Marlboro, Mass. ERNEST HOLWAY

Too Much Skateboarding?

I have a homemade sidewalk surfboard, and, if I may say so, I'm fairly good at it. Your article, *Makaha for Landlubbers* (page 110, November *PM*), helped me to ride the board correctly.

Hales Corners, Wis. PAUL BARBER

I'm glad that *Makaha for Landlubbers* stated that skateboarding is dangerous because it is.

One day while riding down a sidewalk I ran off on the grass. I was thrown to the sidewalk, spraining my arm and bruising my head. It was a month before my arm felt better and my head stopped aching.

I also enjoyed *The Planes That Never Were* (page 130, same issue). I wish there were more stories on vintage planes.

Coatesville, Pa. WALTER HARRISON

We may print more planes. But remember, you'll hurt for at least three months if you fall from a Spad.

The Editors

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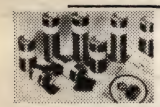

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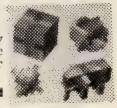

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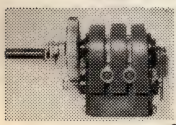

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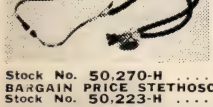

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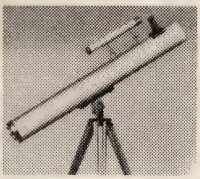

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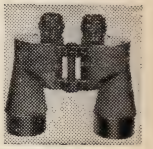

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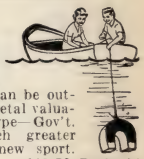

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Quick Wide-Track Tigers—Pontiac GTO and 2+2

Too much television makes some children ill. That was the finding of two Air Force pediatricians who treated 30 youngsters suffering from chronic fatigue, loss of appetite, headache and vomiting. Lengthy viewing produced such lassitude, report the doctors, that the kids were too tired to do anything but watch more TV. But symptoms disappeared within weeks when viewing was cut out entirely or sharply restricted.

Israeli scientists are investigating the properties of an Ethiopian plant brought into their country by Yemenite immigrants. It's been found that people who chew the plant's reddish leaves quickly give up smoking because the habit no longer is enjoyable. No ill effects from the leaves have been detected.

Diborane is a nasty little laboratory oddity. A gas composed of boron and hydrogen, it has no known practical use, is poisonous and explodes on contact with air or water. Yet, a group of scientists at Northwestern University spent over a year and some $100,000 in research money to identify borane as an interim compound formed in an explosion of diborane.

What good is borane? Like its parent, it has no known use—but its identification is a small landmark in basic research.

The horse with the big heart is likely to be a big winner. That was the conclusion of an Australian veterinary scientist who examined the hearts of a number of race horses. Those with hearts near the maximum size (11 pounds in weight) had won 24 times as much money as those with tickers close to the minimum size (5 pounds).

The National Bureau of Standards has new sets of weights—from one-millionth of a pound up—that will not corrode, erode, tarnish or react in any way that will seriously affect mass. They're made from a stainless steel recently developed. Brass, the metal traditionally used, sometimes changes weight.

Paper makes for tender steaks. A major paper manufacturer has come up with a paper impregnated with an enzyme tenderizing agent. Sheets of the paper are placed between cuts of meat stored in the refrigerator or freezer. Because the tenderizer is released in a controlled way, the meat doesn't become overdone, says the manufacturer.

Warning of even the quickest of flash floods on the treacherous Dordogne River in France will be given by a new system of electronic observers. Nine stations are being put in. Some will measure and report minute by minute the amount of rain falling in their areas. Others will transmit water levels in headwater tributaries. A few will do both. Data from all nine will feed into a central station to warn of a flood potential as fast as it develops.

For better diagnosis of ulcers and stomach cancer, a team of New York doctors use a camera and flash unit the size of a string bean to photograph the lining of the patient's stomach. The camera has 16 lenses, each 1/250th of an inch in diameter, mounted so as to produce an overlapping set of photos of the entire stomach lining. The instrument has been used to examine 248 patients, three of whom had unsuspected cases of stomach cancer.

Food made of air bubbles and sea water doesn't sound substantial, but it may be the foundation for much of the life in the ocean. Scientists at Yale University and at Woods Hole, Mass., found that bubbles caused dissolved organic matter to form into particles, much as bits of butter are built up in a churn.

In stormy weather, there are more bubbles and more particles. The particles are believed to be eaten by zooplankton, the sea's tiniest animals, which directly or indirectly feed most of the fish in the sea.

Many blobs of bubble-formed matter sink and pick up more matter as they go down. They may prove to be the inexplicable "snow" reported by bathyscaphe observers in the depths.

Stress on gridiron. Quality football shoes have a stainless steel strip sandwiched between the inner and outer soles. The strip serves as an anchor for cleats. Tests have shown, reports the Iron and Steel Institute, that the soles of football shoes must withstand stresses close to 100 tons

(Please turn to page 20)

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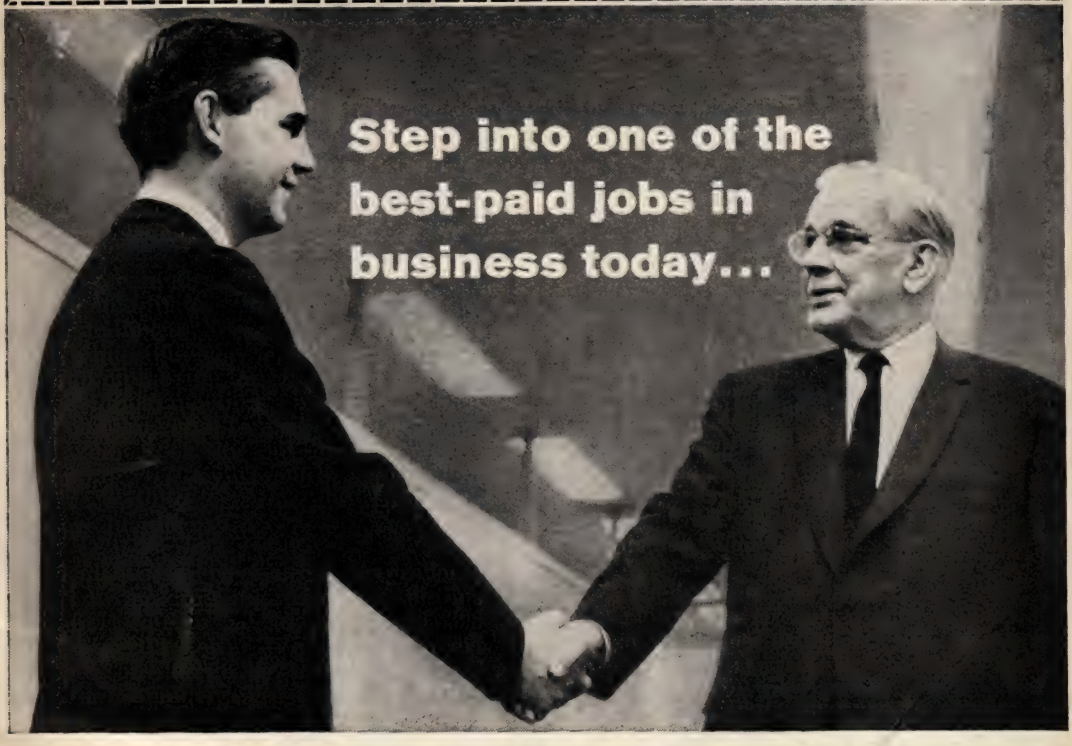

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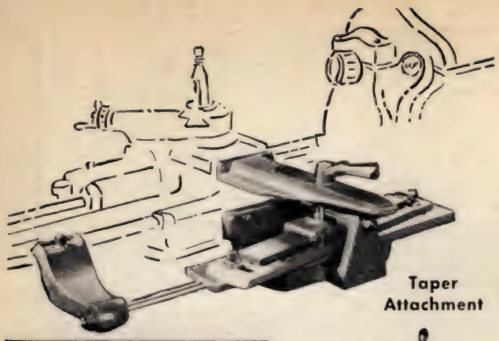

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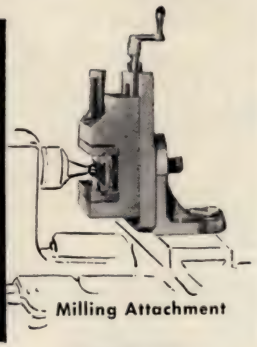

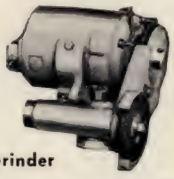

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Science Worldwide

(Continued from page 16)

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Pinpoint radio sources in space may indicate the existence of supercivilizations. That's the thinking of a Russian astronomer who points out that the sources—first observed in 1960 and designated CTA-21 and CTA-102—emit radio frequencies of about 900 megacycles, which is close to the optimum frequency for interstellar communication. No other recorded emissions from outer space approach that frequency.

It's possible, says the Soviet scientist, that a superior civilization would desire to draw attention to itself by broadcasting powerful radio signals.

✓ ✓ ✓

On a long space journey, which would a man find more interesting—a blonde or a beefsteak?

To get the answer to this and a number of other questions, scientists put on the walls of a simulated space capsule just two pictures, one of each of the above-mentioned items. Five men were locked in for a mock journey. At first the voyagers looked most often at the girl, reports the National Aeronautics and Space Administration. But after 30 days on dehydrated foods the men had eyes only for the steak.

✓ ✓ ✓

More lean in your bacon may be the result of Canadian experiments in feeding nicotine to pigs. Scientists observed that introducing adrenalin into a pig's bloodstream caused body fat to become converted into protein. Next they found that nicotine sulphate, fed to pigs in small amounts, would trigger the adrenalin flow.

Three cents worth of nicotine sulphate per ton of feed, say the experimenters, adds $1.70 to the value of each porker by increasing the proportion of lean to fat in the meat.

✓ ✓ ✓

Residents of Succasunna, N.J. (population 7000) will soon be using the most modern telephone system in the country. Developed by Western Electric and called "Electronic Switching System No. 1," the setup provides for services such as these:

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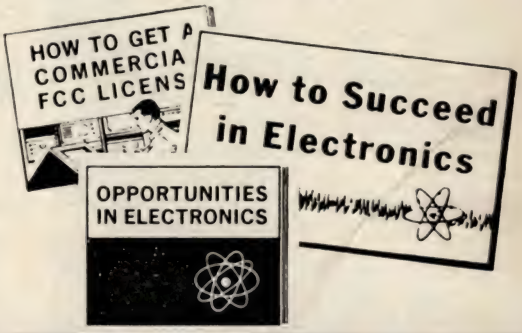

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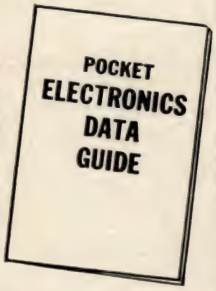

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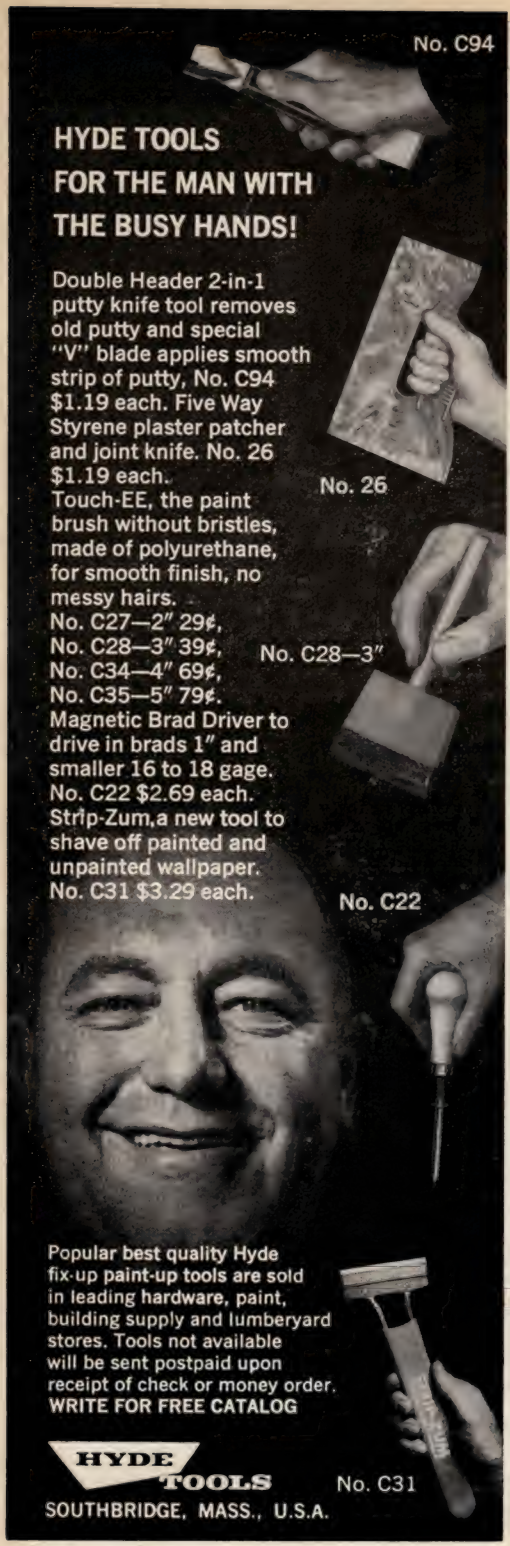
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Science Worldwide

(Continued from page 20)

causes his calls to be transferred to another phone, say his neighbor's.

If you hear a tick, don't sew! That's the rule in the operating room of one Canadian hospital where doctors have come up with a new method of preventing the leaving of a sponge or instrument inside a patient. Equipment small enough to be overlooked is treated with just a tinge of radioactive cobalt—not enough to hurt the patient, but enough to register on a detector.

A nurse passes the detector over the wound when the operation is finished. If the instrument gives the "all clear," the surgeon closes the wound.

Scientists from the Smithsonian Astrophysical Observatory have examined samples of dust taken from Pacific volcanoes and from 750-year-old ice cores in glaciers in Greenland. They report that the dust particles are strikingly dissimilar.

The Greenland dust samples contained shiny spherules (microscopic round particles) with magnetic properties and high proportions of iron content usually not found in terrestrial material. The spherules are thought to be solidified droplets from asteroids, meteors or comets. On the other hand, only a minute proportion of the volcanic particles had the distinctive spheroid shape of the supposed meteoric particles.

Plastic beehives have proved very successful in two-year tests at the University of Wisconsin. They are more durable than honeycombs assembled in wooden frames and help in the control of bee diseases such as foulbrood. The plastic jobs can be sterilized by boiling after use.

Lock your liquor cabinet if there's a hamster in your house. Of six kinds of small animals tested in a University of Helsinki experiment, only hamsters proved to like water spiked with alcohol better than just plain water.

Guinea pigs were almost teetotalers. Hedgehogs chose water most of the time, but now and then liked a nip. Rabbits could take it or leave it alone. Rats, with rare exception, seemed to prefer thirst to drinking the spiked water.

John F. Pearson
Science Editor

TOM McCAHILL SAYS:

"A lot of people could make themselves valuable FAST"

Everyone talks about high school dropouts and automation changing jobs and what to do after retirement. I know some full grown high school students who can't find summer jobs. I have known family men who thought the end of the world had come when the plant moved out of town.

I hope this doesn't sound like a two-bit sermon, but there are solutions to remedy almost any situation. A lot of people could make themselves valuable fast in a job field that nobody seems to know much about—yet, and that's fixing electrical appliances.

As you know, the day is long past when the average home had only one or two electrical appliances. Most homes today are loaded with electrical gadgets that are used for everything from drying milady's hair to cooking dinner and cooling or heating the house.

These appliances break down and that's where you come in.

Appliances have become a major part in our living habits, and in most areas, good appliance repairmen are as scarce as old maids in Corvettes.

What makes sense about this field is that it offers opportunities to men of any age. You'd be surprised at the extra income you can pick up doing good appliance servicing for your neighbors—or the possibilities of starting your own business with little or no investment. There are also good jobs to be had working for some one else who's already in the business.

How easy is it to break into this field?

A lot easier than you think, if you take a look at the home-study course offered by the Appliance Division of the National Radio Institute. You've probably seen the NRI ads. They've been one of the biggest and best schools around since 1914.

The course is good. It's easy. It costs less than many people shell out for one month's payment on that Detroit monster parked in the driveway. They train you fast, in an interesting way, to do some real *professional* appliance servicing on just about every type of appliance from small to large, including most farm and commercial appliances. It even covers small gasoline engines. And they have a separate arrangement to teach you air conditioning and refrigeration.

The point I want to make is this: About the worst thing anyone can do is to sit down and worry about where the extra bucks are coming from. It's not good for your digestive system. It isn't good for those who have to live with you. About the best thing any man can do is help himself.

Do a favor for the guy you see in the mirror every day. Get the details about this course. They send you some books that are worth reading—FREE. Send the coupon below or drop them a note.

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DETROIT LISTENING POST

New Valve Makes Chrysler Steering Behave. Ford's Frisky Colt Gets a New Set of Shoes

Chrysler products' problem with power steering "catch up," the hard bump you sometimes feel if you spin the wheel too fast, should be gone from cars now coming off the line. Shortly after introduction, a new two-stage flow control valve went into the power steering system. Tripped as speed drops to about 3000 r.p.m. it increases the fluid flow from about 2 to 2.7 gallons per minute. At high speeds, where you're much more gentle with the wheel, the new two-orifice system will cut the flow to about 1.8 from 2 g.p.m.

Radial tires have arrived in the U.S. market. Firestone was the first Akron manufacturer to announce radials were actually ready for sale and installation on U.S. passenger cars. Others joined in rapidly, with U.S. Rubber importing its tires from its European subsidiary.

There's lots of confusion about the actual direction of the cord in radials. Try this for a demonstration. Interlock your fingers as though for prayer. They now represent the cord direction—running directly from one bead to the other.

A "belt" the long way around the tire keeps the radial cords together and the tread patch rigid; it's just under the tread.

In the belt, **Firestone** is offering either rayon or fiber glass. The teamwork between Firestone and **Owens-Corning** suggests Firestone may push glass harder; an Owens-Corning executive wrote, with Firestone help, a technical paper complaining that enough rayon for strength "adds undesirable bulk" to the tires.

Before the end of the model year, look for the **Mustang** to get radial tires as original equipment. The high-performance **Goodyears** that Carroll Shelby is putting on his reworked Mustangs already are designed with so high a cord angle that they're almost radials, although they aren't true belted tires. And in spite of Ford's denials, there's talk that a new independent suspension system is on the way for the production Mustang.

Chrysler Corporation's engineers got some deserved salutes at the announcement that disc brakes were to become available on this year's **Barracuda,** which is essentially a restyled **Valiant.** It needs discs, as our Lime Rock tests (p. 92) showed.

But now the word from one of the biggest Chrysler dealerships in the country —factory owned—is that discs won't really be available until sometime in January. Maybe they should be called a '65½ innovation.

Are the roads in your neighborhood getting icy lately? The British, it seems, have a great thing going in this area. Twenty roads in Great Britain have had experimental electrically heated sections (with loads of 200 kilowatts and more) installed. Drivers were enthusiastic and the Royal Automobile Club has been agitating to boost the number ten-fold.

The new NASCAR rules, according to the interpretation by some Chrysler fans, will have their biggest result in encouraging participation of **General Motors** cars. GM maintains its stated no-racing policy, but some of the divisions are reported to be particularly unhappy about the whole thing. Trade publications in the metals field have reported orders from GM subsidiaries for such non-street equipment as magnesium connecting rods. This suggests the possibility of back-door participation in racing by somebody.

Oldsmobile still refuses to talk about the chances for a front-drive car—although few others have such hesitation. Not so generally noised about: The expectation that another front-drive unit will come from Cadillac. This one sounds so unlikely that it's probably *not* the result of someone's wild guess. Today's Caddy products hardly need more interior room, one reason for front-drive. Today's Caddy engines are hardly featherweights, usually desirable if you're going to add drivetrain components as well as engine weight to the front end.

That's the talk, however; make of it what you will.

Automotive Editor

Here's why self-cleaning AC Spark Plugs help you get faster starts, more power!

AC Fire-Ring Spark Plugs help you get faster cold weather starts, more engine power due to the exclusive AC Self-Cleaning Hot Tip Insulator. This thin, tapered insulator of an AC Spark Plug, as pictured above, heats faster to burn away fouling deposits. This discourages accumulation of deposits at the "firing end" of the spark plug. AC's self-cleaning action promotes a reliable, full charge of electricity at the electrode tip every time. This winter, enjoy faster starts and smoother, more reliable performance. Install AC Fire-Ring Spark Plugs—the only spark plugs with the Self-Cleaning Hot Tip Insulator.

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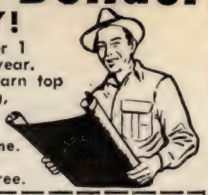

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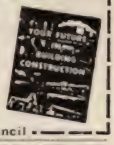

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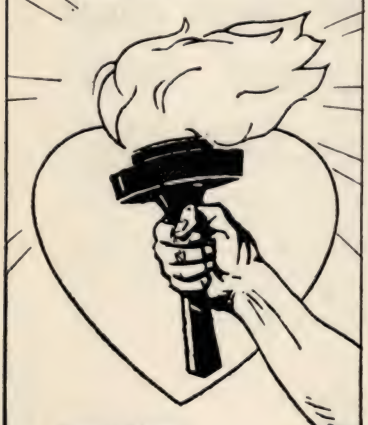


Heart Attack
Stroke
High Blood Pressure
Rheumatic Fever
Inborn Heart Defects

Sidelights on AVIATION

Early Birds, by their own definition, are men who learned to fly after the Wright brothers and before World War I. They still meet regularly, and, at one of their recent sessions, picked their favorite aircraft. One of them was the *Popular*

PM GLIDER as it originally appeared in 1909 issue

Mechanics glider which first appeared in the April, 1909 issue, and had phenomenal popularity. Only God knows how many men made their first flight in it.

It was a do-it-yourself aircraft, and one of the Early Birds, Waldo Waterman dug out the old clips and rebuilt the glider, donating it to the Smithsonian Institution which is now looking for a spot for it.

Easily built, the glider could be lifted up and strapped to the arms, and the pilot

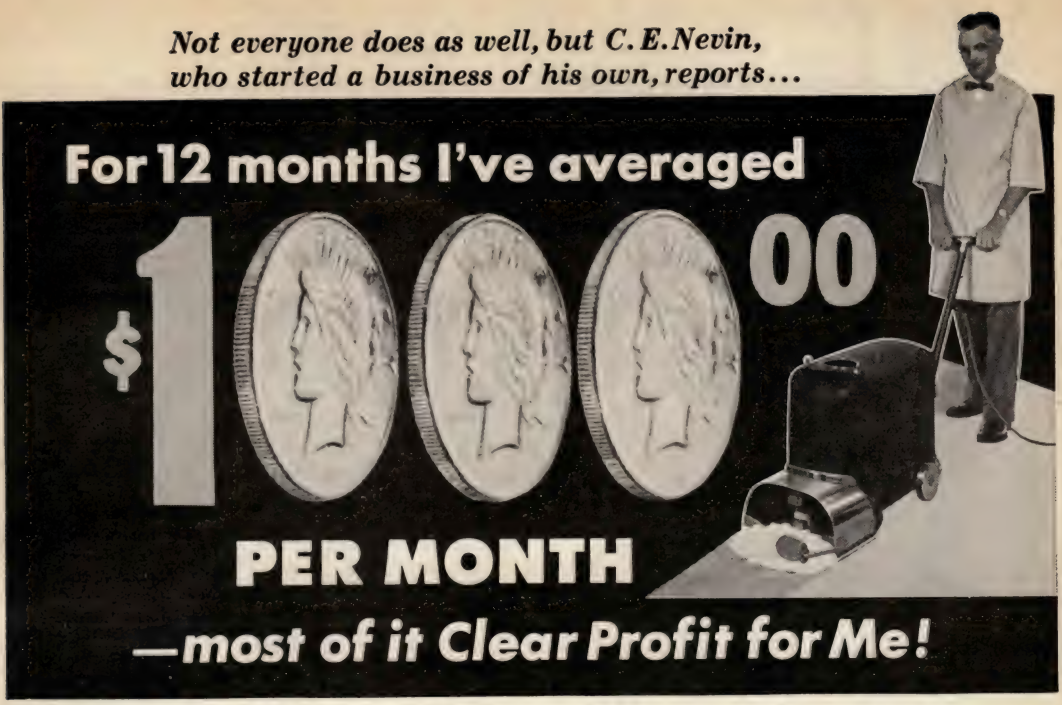
WALDO WATERMAN and his replica at Smithsonian

by shifting his weight could control its flight, usually started by running off the edge of a small cliff.

Wonder how many men today would jump off a cliff with a homebuilt glider?

Kevin V. Brown
Aviation Editor

Not everyone does as well, but C. E. Nevin, who started a business of his own, reports...



• Mr. Nevin expressed his grateful thanks for the opportunity to have a fine business of his own. Many men have discovered how to be independent, to be freed of bosses and layoffs—to build their own future on a steady, dependable foundation. G. Mundt made more than $400 one week. ***A father-son combination grossed $33,000 their first year.*** H. Lemon says, "*I netted $133 in one 8-hour day.*"

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AUGUST RULFS, a Connecticut Associate — "The competition in this area is quite heavy but their method is different than yours and they are unable to produce the high quality of work that I do with my Von Schrader machine."

IRVING E. FLEISCHER, a California Associate — "We have had our Rug Deterger for about five years now and are more than happy with the money we have made with it. I wish to add that there isn't a better company to do business with than the Von Schrader Mfg. Company. You are honest and I can depend upon your word."

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Sidelights from the SERVICES

By William R. Kreh

Parasailing may be a sport for many, but not for the Air Force. The service is using the technique to teach survival-school students what it feels like to bail out over water. Aviators stand on shore with a parachutelike canopy behind them and a rope connected to a motor boat. On signal, the boat starts, the canopy blossoms out and the man is lifted like the tail of a kite. The boat reaches 25 m.p.h., raising the pilot to about 300 feet, where he cuts loose and drifts down like a parachutist.

A missile hangar from a scrapped Regulus submarine may help save lives by being converted to a pressurized surgery chamber at the San Diego Naval Hospital. The missile hangar, which must sustain high diving pressure in its use aboard a sub, is large enough to contain an operating room and may be the answer to pressurized surgery for the hospital without the high cost of installing a regular chamber. The hangar is from the scrapped sub USS *Tiru*.

Pressurized surgery, one of the newest techniques in medicine, involves housing the surgeon, his staff and the patient in a pressurized chamber. Pressurized oxygen against open tissue tends to bring about more rapid healing and better chances of survival of patients who are badly wounded. In some cases, pressurized surgery may eliminate the need of heart-lung machines.

Mobile mill. Instead of carrying loads of steel pipe with it, the Army is going to have a mobile pipe mill. Army engineers are working on a mill capable of cross-country movement along the actual pipeline route. It will fabricate the pipe from coils of steel at the rate of 40 feet a minute.

300 million years old. Energy from the radio source of the constellation Cygnus recently helped dedicate a new Air Force space-age radio research facility. The energy was gathered by a 120-foot-wide antenna to trip a switch unveiling a plaque dedicating the facility at Tyngsboro, Mass.

The facility is built around the antenna, a 150-foot-high radome and a computer. It is a space communication system which can track a target the size of a .22-caliber bullet at 1000 miles, or serve as a radio telescope to produce space maps more accurate than any now existing.

Reproducing algae may provide a source of fresh air for future Navy submarines. A Navy scientist says use of algae could eliminate complicated machinery now used in producing fresh air on nuclear subs. The algae used in the scientist's experiments—the Sorokin of chlorella—taken from a Texas swamp, can double itself in growth in five hours. The oxygen needs of one man would call for about 18 quarts of algae each day.

One of the greatest advantages of using algae to supply oxygen—as opposed to the machinery now used—is that in the process of supplying new oxygen, it removes carbon dioxide and cleans the air of objectionable odors. Separate machines are now used to freshen air, supply oxygen and eliminate carbon dioxide. Algae alone can accomplish all three processes.

Biggest problem to overcome is the development of a more efficient light source for the algae to grow. In the laboratory, 1500-watt incandescent bulbs are used. These consume more power than would be available in a submarine to produce enough algae, so a search is on now for bulbs that consume less power but give more light.

An underwater "wind tunnel" for testing undersea missiles is being built by the Navy. The tank, which will hold nearly two million gallons of water, will be housed in a nine-story building. A spokesman says it will be used like an airplane wind tunnel to test the flow of water around models of various undersea weapons.

A new fire-fighting method has been developed by Navy scientists. It uses two agents—a fluoro-chemical form called "light water," and a potassium-bicarbonate base dry chemical known as "Purple K"—applied simultaneously through a newly developed twin nozzle. In a recent test, the double-barreled system extinguished a 20-by-20-foot pool of burning gasoline in 25 seconds, handled by only one man.

Fish story. There wasn't anything too unusual about Navy Captain S. P. Santiago catching a stingray in waters off Beaufort, S.C., recently. But it became a real fish story after Santiago landed her, and the ray gave birth to triplets. So happens that Capt. Santiago is the doctor in charge of the Beaufort Naval Hospital's obstetrics department.

Irresistible model shown, '65 Chevrolet Impala Sport Coupe

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The 409 makes the switch to the bigger, heftier '65 Chevrolet like it was born there. Leaving you with one problem — deciding which Chevrolet to put it in.

Don't you wish you had more problems like that?

CHEVROLET

Chevrolet Division of General Motors, Detroit, Michigan

Noteworthy New INVENTIONS

By M. J. Pedersen

Shock-absorbing wheel has five tube-shaped spokes with a spring inside each spoke to absorb shocks or bumps. Especially useful in transporting hospital patients, since it minimizes jars and jolts, it earned patent 3,154,127 for John M. Felton, Philadelphia, Pa.

An axe can shoot tear gas into a room from a tube that opens at the face of the axe. Standing to the side while swinging the axe into the door, a policeman merely needs to pull a ring to release the tear gas grenade, thus avoiding the danger of facing the muzzle of a trapped criminal's gun. Carl Weinert of Pittsburgh, Pa., earned patent 3,152,417 for his police saver, which was successfully tested at the FBI Academy at Quantico, Va.

School bus safety gate, which prevents children from crossing in front of the bus until it is safe, received patent 3,153,398 for George La Verne Runkle and Gilbert S. Sheets of Lima, Ohio. Hinged to a special front bumper, the gate swings out from the bumper to a position parallel to the bus. Controlling the gate inside the bus, the driver can open the front door to allow the children to stand on the curb behind the gate.

A waterwheel-shaped parking garage handles a number of cars in minimum space. Invented by Kyosuke Mori of Tokyo, Japan, this new rotary garage was awarded patent 3,153,488.

A remote utility meter reader provides a reading station outside the home, permitting the meterman to take a reading from the meter inside merely by plugging a jack into the outside station. Eliminating the disturbance usually associated with the meterman's monthly visit, the invention received patent 3,153,780 for Edward L. Zaubi, Springfield, Ill.

Volcanic rock particles could be used for covering open cesspools, according to patent 3,113,924, granted to Carl Mendius, Jr. of Naperville, Ill. The glass particles expand under high temperatures to form a honeycomb structure which would float on top of a cesspool, reducing odor to a minimum and preventing freeze-ups.

Computers a hundred times faster than today's models may become possible with a new superconducting film which has little resistance to electricity at very low temperatures. Developed by Dr. Hans W. Meissner of Stevens Institute of Technology, the film consists of two metals electroplated together so that electrons from the two mingle together. Granted patent 3,115,612, the film must await the perfection of cryogenic (supercold) refrigerators before it can be utilized.

Auto exhaust pipes won't continue polluting the atmosphere if patent 3,119,231 proves feasible. William E. Cook of Van Nuys, Calif., has developed a compressor which forces exhaust gases into storage tanks; these would be emptied at intervals as part of regular car maintenance.

Lifeguards may soon have motorized sleds on which to speed to the aid of drowning swimmers. Rescuers guide the sled with their legs, with victims carried on the front of the vehicle. Patent 3,119,364 was awarded to Hugh O. Brown, Playa del Rey, Calif.

Bomb detector to screen unopened airplane-bound luggage, using nuclear engineering techniques, received patent 3,146,349 for Dr. Edward D. Jordan, Kensington, Md. If radiation, coming from nitrogen in the explosive or from boron that is "seeded" in the explosive during manufacture, is detected, an alarm is triggered.

Car doors lock automatically during a collision when equipped with a safety control system. A tilt-responsive switch also unlocks the doors (so passengers can escape after the car flips) and kills the engine, thus lowering the threat of a gasoline fire. A mercury bead floating in a switch under the car closes the circuit when it judges a car is accelerating or decelerating beyond a predetermined rate. Samuel C. Pollock of Rochester, Mich., received patent 3,151,698 for his system.

A magnetohydrodynamic generator to supply power to a space vehicle, using for fuel the atmosphere through which the craft passes, earned patent 3,156,433 for Edward A. White, Jr., of the Naval Ordnance Laboratory, White Oak, Md. Several prototypes of such a generator have been built.

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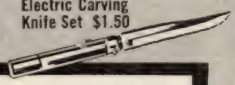

Electric Carving Knife Set $1.50

This exciting list shows just a few of the startling buys which have been announced. Newer, fresher offers will be sent to you every month. I could make up a list like this every week, based on news I receive from my overseas sources.

Man's Briefcase	.85	Electric Blanket	4.96
Hand-carved Clock	.65	8mm Zoom Camera	24.35
Fishing Rod-Reel	.50	Teakwood Chest	.90
Elec. Hair Dryer	3.25	Hockey Stick	.70
Cigarette Lighter	.21	Portable T.V.	47.50
Motorcycle	118.50	Star Sapphire Ring	6.00
FM Hi-Fi Radio	8.80	Elec. Can Opener	6.40
Movie Title Kit	1.00	7-pc. Fishing Kit	.50
Beaded Handbag	1.01	Beer Stein	.13
Flashlight	.10	Sunglasses	.15
Transistor Radio	1.70	Marking Pen	.12
Cardigan Sweater	2.00	Disposable Razor	.02
Spinning Reel	.96	Sewing Machine	3.15
Stop Watch	1.12	Star Saphr. Pendant	2.50
Wrist Radio	2.90	Electric Shoe Shiner	1.55
Model Boat Kits	.65	Port. Typewriter	22.50
Table Tennis Set	.29	Windbreaker Jacket	1.20
Ladies Knit Suit	4.50	Tailored Man's Suit	22.50
Intercom Set	5.00	Electric Toothbrush	1.25
Electric Scissors	1.32	Elec. Fishing Rod	9.00
Human Hair Wigs	12.00	20-pc. Dinnerware	1.15
Plastic Raincoat	.14	4-pc Steak Knife Set	.17
Water Pistol	.05	Swiss Musical Bank	1.00
Dozen Golf Balls	1.83	Elec. Immersion Htr.	.19
Slide Viewer	1.20	24-pc. set Flatware	1.55
Ladies Gloves	.16	Butane Cig. Lighter	.60
Ukelele	2.00	Electric Hair Comb	1.49
Massage Unit	1.64	Expand. Watch Band	.11
Oil Painting	1.25	Laminated Skiis (2)	13.66
Adding Machine	18.00	Elec. Pencil Sharp.	1.26
Electric Train	1.50	Hunt. Knife & Sheath	.11
Knitting Machine	4.20	Embroid. Sweater	5.50
Badminton Set	.60	Elec. Hand Grinder	1.23
Radio Spectacles	7.70	Hd.Painted Wall Scroll	.77
Tennis Racket	.50	7-pc. Golf Club Set	22.25
Rifle Scope	1.85	Austrian Ski Sweater	5.46
Water Filter	1.90	Port. Radio-Phono	13.00
Check Writer	8.80	Elec. Knife Sharp.	5.05

Prices subject to availability and market fluctuation

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CLINIC FOR HOMEOWNERS

Q **I want to make a durable whitewash for use on a board fence and the interior of several outbuildings. Just lime and water won't do. I want something that will last at least a season without crumbling and peeling. Can you tell me how to make such a wash?—C. Y., Ga.**

A Ordinarily we do not recommend what is commonly referred to as whitewash, as there are several outdoor paints which are superior substitutes. However, it is a cheap finish and for the interiors of rough buildings where it is desirable to renew the finish often it does have some advantages. For such uses, the common whitewash, which can be made for a few cents a gallon, is quite suitable. If you are applying a first coat over a surface which has never been finished with any coating, make sure it's clean, free from any oil spatters, cobwebs, dust and other debris which may cling to rough boards or masonry. Another step that adds greatly to the durability of a common whitewash coat is wetting the surface before application. Allow to partially dry—the surface should never be sloppily wet—and then apply the wash with a wide brush or by spraying. A whitewash formula for exterior use can be made by mixing casein powder, trisodium phosphate and whiting in about equal parts. Add water to make an easy brushing or spraying solution.

Q **How can I make a small room appear larger? Room is L-shaped and there are two windows on the long wall. Ceiling is 9 ft. high. What's the best way to lower it?—F. N., Kans.**

A To enlarge the room we'd suggest you paper the window wall and cover the windows with a drape that matches the wallpaper. This will have the effect of lengthening the wall, especially when the drapes are drawn, making the room appear larger. In some small rooms with high ceilings, installation of a wainscoting of wood strips running lengthwise will have much the same effect. There are now available suspended grid-type units

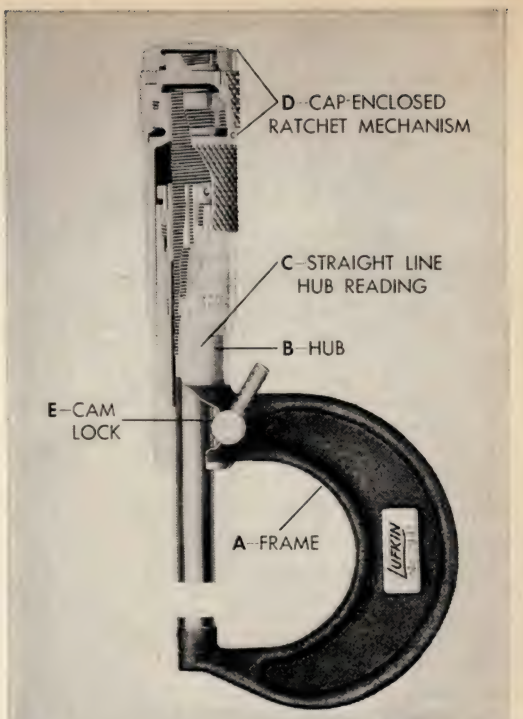
for lowering high ceilings. Metal parts are usually aluminum and consist of a grid formed by angles and tees which support panels of acoustical, louvered, and translucent materials. These materials can be arranged in almost any desired pattern or combination. Such suspended ceilings are comparatively easy to install. Parts are available from building supply dealers.

Q **I have a seepage problem in my basement. My plumber tells me to install a sump pump with an open bottom (gravel) to take the water out from under the concrete slab. Will the pump run continually, or only at intervals?—M. L., Ohio**

A We don't know. If there is a subsurface water table that remains at the level of, or only slightly below, the basement floor, then the pump could run continuously. However, this seems unlikely. What is more likely is that the seepage into the basement (we're assuming the seepage is through the floor only) is due to surface water that gradually filters down through a porous light soil to the basement floor level. In that case, the pump would only operate at intervals. What your plumber is suggesting, no doubt, is the installation of a pump to remove this surplus seepage water and prevent it from coming through the floor, either through hairline cracks or at the points where the floor joins the walls. There are concrete patchers and waterproofers available which can be feathered to fill fine cracks in a floor and filleted in the corners.

Q **My gutter downspouts enter drain tiles and the concrete cap in the bell end of one of the tiles has broken up, requiring replacement. But how does one replace such a cap?—F.H., Ill.**

A First, remove all the broken concrete, taking care that none of the pieces drops into the tile. Then remove a lower section of the downspout and cut a disc from ⅜-in. hardware cloth to fit inside the bell end of the tile. In the center of this disc cut an opening to take the end of the downspout in a snug fit. Reposition the length of downspout and slide the disc down into the bell end of the tile. Then mix a stiff cement mortar (or use a ready-mixed cement mortar) and trowel around the downspout, building the new cap up around the spout to a point slightly higher than the top edge of the bell end of the tile to form a slope to shed water.



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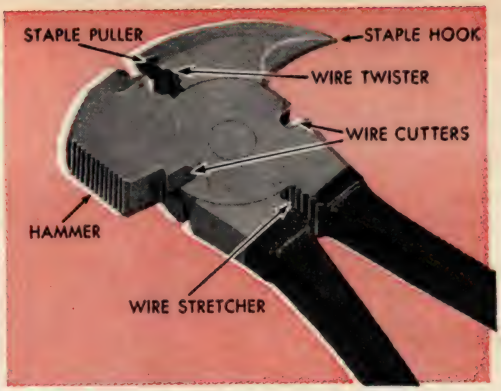
THE LUFKIN RULE COMPANY/Saginaw, Michigan

Shopping for Tools

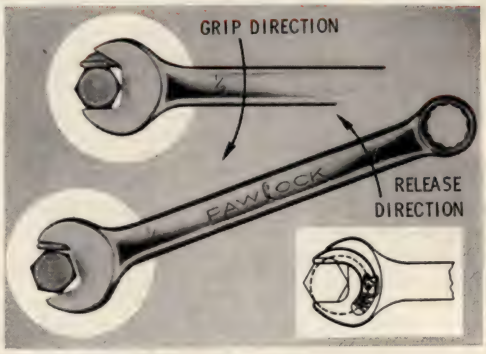
Tool "Kit" Fits in One Hand

A new combination device, called a Utility Tool, has been introduced. As shown at the right, it does the jobs of several individual hand tools—hammer, wire and nail cutter, staple hook, staple and nail puller, wire twister and wire stretcher. The tool is a natural for fence building. It costs $2.45 from Witherby Division of John H. Graham & Company, Incorporated, 105 Duane Street, New York 8, N.Y.



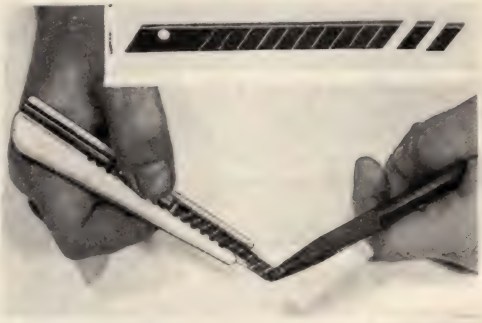
Wrench Thinks for Itself

A new ratchet-type open-end wrench from Briles Manufacturing has a spring-actuated movable pawl in one jaw. Pull the wrench one way and the pawl grips the nut. Pull the other way and the pawl retracts into the jaw, releasing its grip. Should save not only the knuckles, but the tempers, of auto mechanics and others who work frequently in tight areas. Price is $19.70 for a set of five (3/8 through 5/8 in.). Manufacturer is located at 1415 East Grand Avenue, El Segundo, Calif.



Knife is Self Sharpening

When the cutting point of the Blade-O-Cutter utility knife gets dull, you can renew it by merely snapping off a small section of the blade with a pair of pliers. Since the blade is scored at the factory, breaking is quite easy. Blades are replaceable, and retract into the handle for carrying in your pocket. Each one has a total of twelve renewable points. Knife costs $2.25 postpaid, extra blades 35¢ each. A dispenser of 10 blades is $3.50. PKS Originals Co., Box 423, Great Neck, N.Y.



Catches Sawdust on the Fly

Latest accessory for the Shopsmith Mark VII is a Sawdust Collector/Guard that clamps to the machine's headstock. As its name implies, the purpose of this attachment is not only safety, but to channel the sawdust directly into the Shopsmith's built-in vacuum by way of a spout which connects to the vacuum hose. Works with any spindle-mounted tool (sanding disc, grinding wheel, etc.) that doesn't project over 1/8 in. beyond end of spindle. Price is $9.95. Magna American, Box 15126, Interstate 75, Evendale, Cincinnati 15, Ohio.

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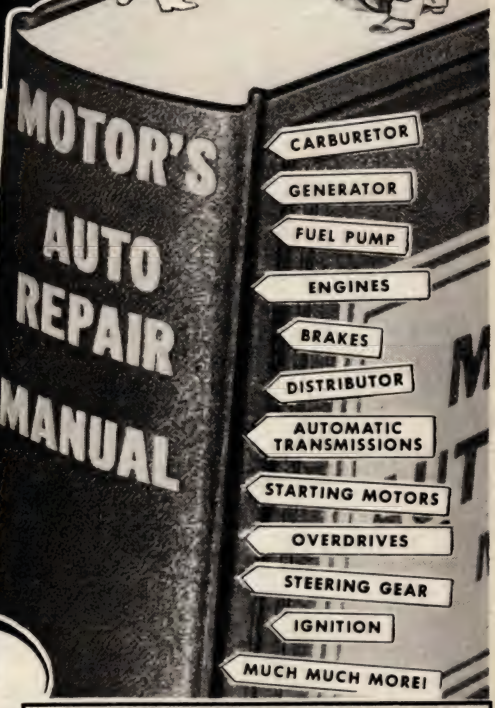

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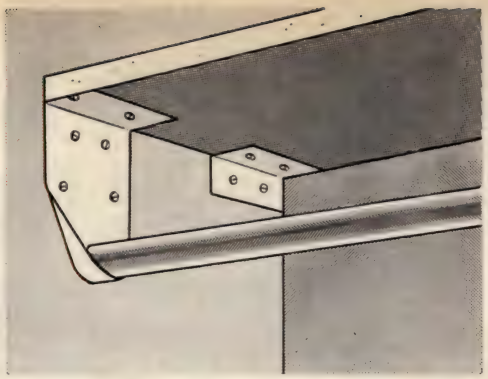

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Model builders can now buy a tiny motor that's only ½ in. in diameter and 1⅛ in. long. Runs at 8000 r.p.m. on a single 1.5-V. penlight cell, 13,000 on two penlight cells connected in series. The Aristo-Craft "Baby" sells for about $1.25. From Aristo-Craft Distinctive Miniatures, 184 Pennsylvania Ave., Newark, N.J.

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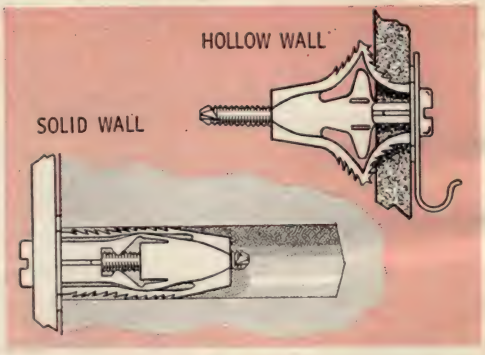
The Wonder Anchor is an expandable fastener that holds itself in either hollow or solid walls. Its Nylon fins expand when you tighten the screw. In hollow walls, the fins lock behind the wall surface. In solid walls, the grip is provided by teeth on the fins. Four for 36¢. A. A. Rice, Inc., Port Washington, N.Y.



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A new multi-purpose clear epoxy sealer is said to apply easily with a paint brush. For sealing shower stalls, basement walls, swimming pools, boat hulls, etc. Or, mix it with sand and you have a filler for cracked pavement. Retails at $5.95 for a two-pound package. Made by Devcon Corp., Danvers, Mass.

The Thin, Flexible Backing of Scotch brand vinyl plastic electrical auto tape No. 81 (not shown) offers two advantages over other plastic electrical tapes, says the manufacturer. These are: tighter wrapping of joints, and easier tearing from the roll. The product, which is intended primarily for use in auto shops, comes in 20- and 60-ft. rolls, costing 69¢ and $1.99 each. Made by 3M Company, 2501 Hudson Road, St. Paul, Minn.

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Items from All Outdoors

The place was the Fishing Tackle Manufacturers Show in Chicago, the time was this past fall, and I was swapping fish tales with Rusty Thompson of Minneapolis and Harry Heinzerling of Creek Chub Bait Co.

"I'll tell you about fishermen," Harry said. "Take Rusty, here. He even named his son after a fish."

I didn't believe it, and when Rusty, a big man with a laugh to match, stopped chortling, he explained: "His name is really John."

"Nonsense," Harry snorted. "John might be on the birth certificate, but his name is Pike."

"Well, that's easily explained," Rusty said, unabashed and quick with the "logical" answer. "The boy was adopted and the day he arrived was the opening day of northern pike season, and I had the best day ever. Just seemed like a lucky name."

Pike Thompson. Incidentally, he is 16 years old, his passion is white-water canoeing, and he likes his name. But, as Harry said, that's a fisherman for you.

The talk went round and round, and then I asked, "What would you say is the most important thing to happen in fishing in the past 20 years?"

"The closed-face spinning reel," Harry said without hesitation. "I don't think anybody would doubt that. By eliminating the backlash, that reel opened up fishing for thousands upon thousands of people who would never have spent months learning to cast with a bait reel."

And about five minutes later I met R. D. Hull, a rugged looking outdoorsman, who is a vice president of Zebco, and is the man who invented the closed-face reel.

"I think I would have given up fishing in my learning days if it hadn't been for my younger brother," the soft-spoken Texan said. "I never could cast without a backlash, so he'd carry the plug to the far side of our pond and I'd just haul it in."

Working as a watchmaker, Hull spent 20 years developing his reel. The first model, for instance, was six inches in diameter. In 1948 Hull took his invention to Tulsa and convinced the Zero Hour Bomb Co. that they ought to go into the fishing business. The rest is history. Within five years the new reel had revolutionized the industry.

Stuart James

Outdoors Editor

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Watch repairing is the stepping stone to success in the jewelry business. Most jewelers started out as watchmakers, repairing on a small scale, then adding a stock of jewelry and gradually building up to a store. That's the way some of our largest and most successful jewelers got their start—with nothing more than a set of tools and a bench in some store window. Others began in their own home.

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A constantly expanding market

An article in the Chicago Sun-Times, Sept. 27, 1964, pointed out that Americans buy 25,000,000 watches *every year* in all shapes and sizes.

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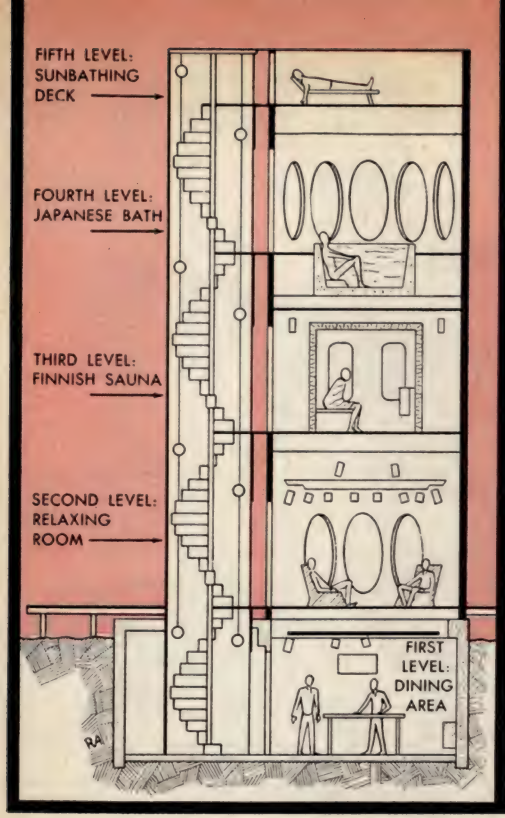

For That Well-Scrubbed Look—a Five-Story Bathroom

Bathers have a choice of hot air, hot water or sunshine in a new residential bath tower built in Stony Point, N.Y. Two other levels of the five-level tower offer a relaxing room and a dining room. In the Japanese bath, the bather can submerge in near-scalding water, and in the sauna he can bake in 230-degree air. The steel and redwood structure was designed and built by architect-owner M. Medcalfe.

Lyrebird Is a Recording Star on the Spectograph

The various calls of Australia's male lyrebird, noted for his vocalizing and the lyre-shaped feathers in his long tail, are being taped in his natural surroundings. Object of the research is to learn what motivates the bird to sing and the meaning of its song. Tapes are fed into a sound spectograph (right), which produces graphs that show subtle differences in calls that are indistinguishable to human ears.

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You can start either doing service yourself or employing full or part time servicemen. This business is easy to learn . . . easy to start. Rendering service is so easy that women dealers often do it. We prefer you have no experience . . . not have to "unlearn" old methods.

The national price guide provides an hourly gross profit of $9 on your own service work plus $6 on EACH serviceman. It's $12 on 2 servicemen, $18 on three, etc.

A very small dealer just starting and doing his own service should gross $180 profit from 20 hours service in a week. If he uses 30% for advertising, etc., he nets a clear $125. On 40 hours of service his net profit is $250.

With only two servicemen doing all the work for him, a 35 hour week brings the owner $420 gross profit. Allowing only 20% for advertising etc. (since owner has time to help sell), he clears $355.

Your income is proportionate to the number of servicemen you employ. If you have the ability, you can own several dealerships. You can operate from a shop, office, or **your home.** Equipment is light, portable. All you need is a phone and car.

The 24 page illustrated booklet we'll mail you FREE explains in detail why profits, operating either alone or with servicemen, are greater than you expect.

We are NOW enlarging this worldwide system of individually-owned service businesses. If you are reliable, honest and willing to work to enjoy success, we invite you to mail the coupon.

When you receive our fully illustrated booklet, you will see how we show you **step by step** the way to get customers . . . then still more customers from their recommendations . . . and why the business of a Duraclean dealer **grows.**

You have 6 superior services that are rendered "on location" in homes, offices, hotels, theaters, churches, clubs, motels, stores and institutions.

These are not ordinary services. You have the **prestige** and **endorsement** of leading furniture makers, carpet mills, Parent's Magazine and McCall's and of Research and Testing Laboratories.

Ads in national magazines explain **your** services' superior merits, build customer confidence in **you** and bring job leads to **you.** Your ads appear in McCall's, House Beautiful, McLean's, House and Garden, Canadian Weekly La Presse and other quality magazines.

You will have pre-tested local ads and a complete **result-getting** mail program.

Stores, upholsterers, insurance adjustors and decorators refer jobs to our dealers. These year 'round services are in constant demand.

We and a Duraclean dealer will train you and assist you. We reveal the proven ways to **quickly get customers** and **create a sound business.**

Start Small, Grow Big in this Booming Business

Many men have said to us, "I can't afford to give up my job till I know I have a sure thing . . . a sound business that will provide both security and a better living for my family."

That made sense to us so we worked out such a plan . . . and those same men are now enjoying a Duraclean dealership in many communities. You don't experiment. You use **tested, proven methods.** You have **our backing** and **"know how."**

Does this appeal to you? Don't decide now. Mail the coupon so you'll have the facts to decide wisely. There is no obligation whatsoever. You will then know whether this is what you want.

You can start small and grow big. A third century ago Duraclean was an idea . . . but it caught fire and spread to a worldwide service. Why did it spread? (1) **Superior processes.** (2) **Proven customer-getting methods.** (3) **Day to day guidance from Headquarters.**

Our first service, the care of carpets and upholstery, not only cleans. It also enlivens the fibers . . . revives dull colors. Pile rises with **new life.** There's no harsh machine scrubbing. No soaking. Mild aerated foam lightly applied lifts out dirt, grease and many unsightly spots. Use furnishings again in a few hours.

Government figures show that service businesses now grow faster than stores and industries . . . $750 million yearly potential just cleaning furniture and rugs. Your **5 other services** are fully explained in the free booklet we'll mail you without obligation.

Just a few hundred dollars establishes YOUR OWN business. A day's profit more than takes care of the monthly payments. Men frequently take in partners.

We furnish electric equipment and, with first shipment, enough materials to **return your TOTAL investment.** If you have good habits and know the importance of customer satisfaction, you can likely qualify for a Duraclean dealership.

TODAY is the time to reserve your dealership, before your location is taken.

It's been said: "Opportunity knocks but once at every man's door." This may be that one opportunity in **your life.**

The simple act of mailing this coupon may change your whole life...as it has done for hundreds of others. It costs you nothing to find out. No salesman will call. From the facts we will mail you, in the quiet of your home, you can decide whether to apply for a dealership. So, with **no obligation whatever,** mail the coupon TODAY. Cut it out now so you don't forget to mail it.

If You Want Your Present Location, Mail Coupon Without Delay—TODAY

GOOD LOW-END TORQUE enables 1100D to make a respectable showing at stop lights. The car is maneuverable in traffic, thanks to fine steering. Maximum recommended payload, including the driver, is over 800 pounds

Midget Wagon with a Hot Rod Heart

Want to be frisky on 28 miles to the gallon? Then try the homely but lovable Fiat 1100D

By Alex Markovich

THE FIAT 1100D wagon has the stubby grace of a small panel truck, the quiet smoothness of a go-kart, and no frills in sight anywhere. It looks *terribly* practical.

Yet, amazingly, it's a ball to drive.

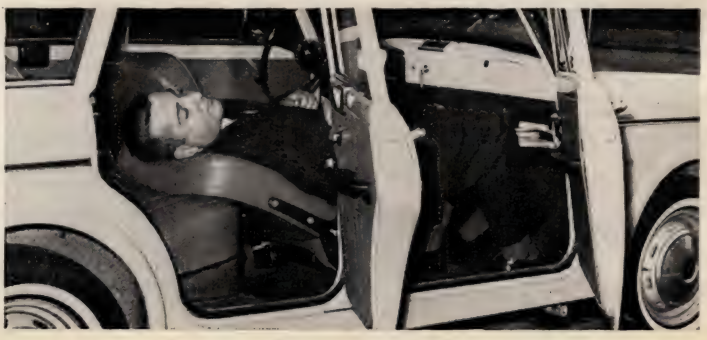
The 74.5-cu.-in. engine squeezes out only 55 hp., but this is good enough to push the wagon from zero to 60 in 20.2 seconds. The 40-60 and 50-70 times are 11.1 and 17.2 seconds—better than most of the competition can do. The car's innate eagerness makes it seem even faster.

The engine starts easily with a minimum of choking, and its exhaust note is pleasantly sporty. But the long-stroke four is rougher than most, especially at high speeds and during acceleration, and its vibration is transmitted throughout the unitized body. There's also lots of road noise.

The transmission, too, is noisy, but it works beautifully. The column linkage is surprisingly crisp and precise, and the

(Please turn to page 46)

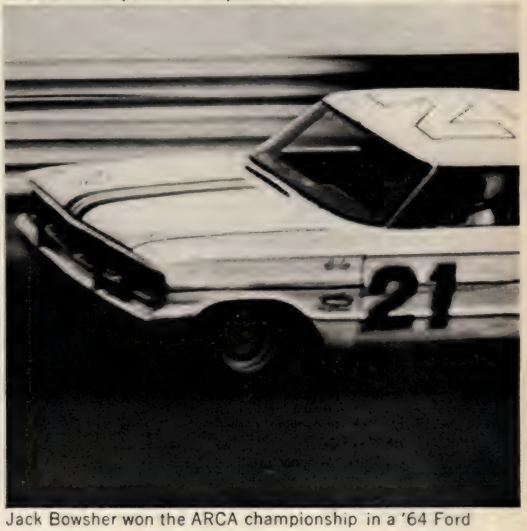
FRONT SEATS recline with a flick of a lever. Seat backs are too short for comfortable napping, but rake adjustment is handy while driving. Doors have no stays, were held open for photos



A. J. Foyt won the Indianapolis "500" and the USAC championship with an Offenhauser

Jim Hall won the U.S. Road Racing championship in a Chevrolet-powered Chaparral

Richard Petty won the NASCAR championship in a '64 Plymouth



Jack Bowsher won the ARCA championship in a '64 Ford

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P.S. For dependable power all winter, install new silvery-plated Champions now!

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Craftsman offers startling savings on top name power tools, hard to find cabinet hardware, lamp and upholstery materials. More than 1,500 items. Packed with new patterns, projects. Enclose 25c to help pay mailing and handling costs.

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Rush giant new Craftsman WOOD Catalog. I enclose 25c to help cover mailing cost

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City_____ Zone_____ State_____

Spotlight on the Fiat 1100 D

(Continued from page 44)

HANDBRAKE takes a long reach. Speedometer showed km.p.h. It was wildly optimistic—11 percent at 40-60 m.p.h. Cars sold here will register m.p.h.

synchronizers on the top three gears are practically crunchproof. The nonsynchro first gear is no problem; second gear pulls nicely from a walking pace. And adept shifters can double-clutch into first.

Steering is quite easy, fast and extremely precise. The big aluminum brake drums require hefty pedal pressure, but they stop fast and straight every time. The clutch allows no slippage. The wheel well extends close to the clutch pedal, and interfered with my E-width feet; I found, however, that I could cheat a bit on pedal travel without provoking expensive noises.

Ride is a bit harsh on bad roads, but smooths out at higher speeds. Road-holding is excellent, and steering feels neutral in a corner.

Plenty of glass area assures good visibility, and front fenders are raised, making it easy to squeeze through tight spots.

The cockpit is comfortable, though bleak. The steering wheel is nicely placed nearly at arm's length. Ventilation and heating are beyond reproach. The barren, bare-metal dash (just the bottom is padded) houses a horizontal speedo that's as easy to read as a Mongolian newspaper. There's also a gas gauge, a nonlocking glovebox and an aurora borealis of warning lights. A handy touch is the full-width package shelf under the dash.

A minor gripe: the side windows take a ridiculous 5½ turns of the crank. And the side mirror is partially blocked by the A

(Please turn to page 48)

$1050 GROSS IN SINGLE MONTH IN MY OWN BUSINESS

F. E. DORAN reports

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START YOUR OWN BUSINESS NOW! • Here's YOUR chance to start a money-making, year 'round business of your own and make the success you've dreamed about.

G. R. Adcock took in $102 in one day. O. W. Hare landed a $750 hotel job. J. S. Corbit grossed $279.50 his first month. Homes, hotels, offices, clubs, offer you big profit possibilities. Auto upholstering also.

NO SHOP NECESSARY • You clean upholstered furniture with efficient PORTABLE ELECTRIC DETERGER on customer's premises. No hauling, no high rents; you operate from your home. Supplies cost little; what you take in is mostly profit.

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Without obligation rush your **FREE** booklet about how I can start my own permanent, profitable electric Upholstery Cleaning business.

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Step into this fast-moving Accident Investigation field. Train quickly in your own home in spare time. *Already* hundreds of men we have trained are making big money. Joe Miller earned $14,768 in one year. A. J. Allen earned over $2,000 in ten weeks. William Roane says "I'm now earning $300 a month *extra* investigating accidents in my *spare time*... Universal's course is wonderful."

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Right now there is an acute shortage of men who know how to investigate accidents. Our *proven* and *approved* training makes it easy for you to step into this huge, expanding field.

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You can be your own boss. Independent accident investigators average $6.44 an hour. Let us show you how to start *your own* profitable business. Begin part time — with your home as headquarters. Later expand to full time. Or if you prefer to be a Company Claims Investigator — our Placement Bureau will assist you. Leading firms call upon us for trained men. Enjoy big pay, your own secretary, a car for personal use, and all business expenses paid.

EASY TO START — NO SPECIAL EDUCATION OR PREVIOUS EXPERIENCE NEEDED

We know the Accident Investigation Business from A to Z. We *can* and *will* show you how to get into this exciting new career in just a matter of weeks. You can more than pay for the entire course with your very first check. Send today for FREE BOOK. No salesman will call. You are not committed in any way. Just mail the coupon or send a post card to me, M. O. Wilson, Universal Schools, Dept. PM1, Dallas 5, Texas.

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MASON SHOE, Dept. F-747, Chippewa Falls, Wisc.

Spotlight on the Fiat 1100 D

(Continued from page 46)

STRAPS hold rear seat down to form a flat luggage area. Side-hinged rear door is convenient except when you're parked close in front of another car

pillar. The rear-view mirror, however, is well-placed. It has a dimming adjustment and incorporates a courtesy light.

The best interior feature is the seats. They're well-padded and upholstered in durable-looking leatherette. My test car had tasteful cowhide-colored pleats. The wide range of front-seat adjustments accommodates people of all sizes. The seats are high, which increases legroom and, along with the big and wide-opening doors, makes getting in and out easy.

The rear seat is also comfortable, though legroom is just fair. The seat folds to form a long and flat, though narrow, luggage area. This folding rear seat, incidentally, is optional in 1100D sedans.

Inside door handles must be lifted to open—a worthwhile safety feature. Lowering them locks the doors. Only the driver's door has a key lock. Unfortunately, Fiat supplies two different keys, one for the door and another for the ignition.

One really endearing feature is the price—only $1759. This includes a tool set, windshield schpritzer, an abundance of grab handles on and above the doors, anchor points for seat belts and harnesses, and a horn that, with the flick of a switch, can be adjusted to bleat or blare.

There's also fuel economy. My tests netted the following figures: 37.59 m.p.g. at 30 m.p.h.; 36.20 at 40; 29.58 at 50; 27.88 at 60; 25.30 at 70; 28.62 overall. All told, the 1100D wagon adds up to one of the biggest bargains on wheels. ★★★

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POOL BOAT Powered By Garden Hose

by Mario Morselli

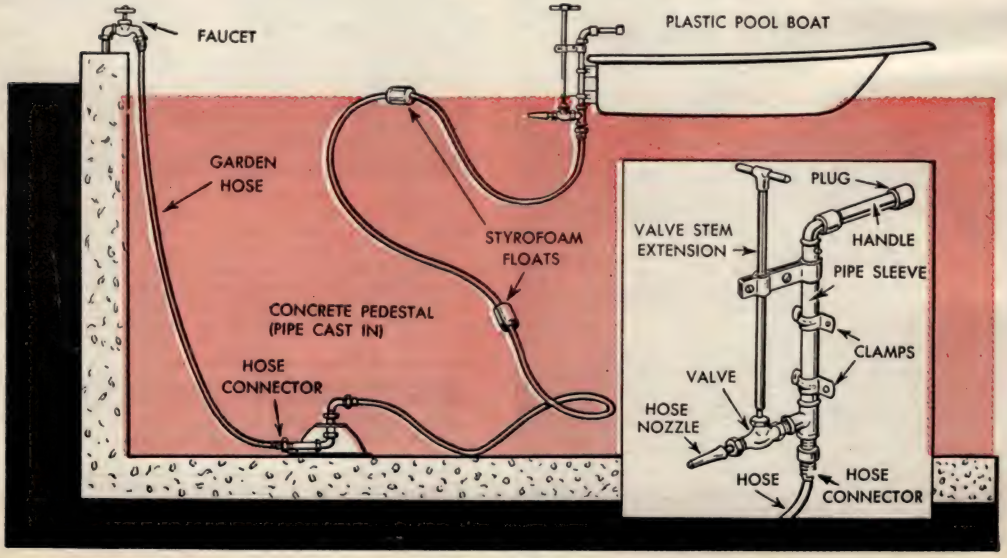
SLOW-BUT-SAFE acceleration of this tiny tethered squirtgun is still fast enough to give the small driver a thrill. Take a look at that broad grin

WITH A RANGE limited only by the length of your garden hose, this dandy jet-powered plastic runabout will provide hours of fun for the small fry. While designed for cruising around a swimming pool, it could just as well see service as a coastal patrol craft at your waterfront summer cottage.

Construction of the jet propulsion system may look like a plumber's nightmare at first glance, but it's actually quite simple. To make the transom unit, assemble the stock plumbing components as shown in the detail, then drill mounting holes in the transom and bolt it to the boat, sealing these through-hull fittings with calking compound. The swivel base is made by casting pipe in a concrete pedestal.

After slipping float sleeves of styrofoam over the hose to reduce drag, turn on the faucet and stand clear.

DEMONSTRATION of the power used to drive the pool boat might give you the impression that it was designed for racing. Actually, it's safe as a raft



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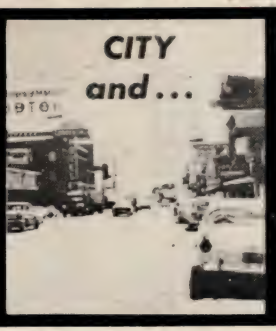

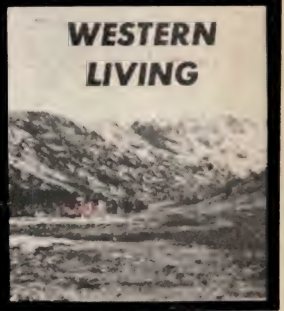

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THE VERY BEST FEATURES OF TWO WORLDS

...THE WORLD OF THE WEST Located in prosperous Elko County, the ranchos have the backdrop of the majestic Ruby Mountains. **The sparkling Humboldt River is a short ½ mile away. Every Rancho fronts on a graded road that leads into coast to coast U.S. Highway 40.** Amidst these spectacular surroundings MEADOW VALLEY RANCHO owners can relax and enjoy the wonderful life of the Golden West.

...THE WORLD OF CITY CONVENIENCES: The bustling city of Elko with its modern schools, shops, theaters, hospital and airport is only 1½ miles away. New homes, with FHA financing committments issued, are now under construction... less than 1 mile from the property. The Experienced, Successful Developers of MEADOW VALLEY RANCHOS are not offering remote land where purchasers have to hope for progress and expansion. They offer you the opportunity of a life time, a chance to participate in Nevada's continuing boom... Minutes from the conveniences of hospitable Elko, in the midst of current growth and progress, **MEADOW VALLEY RANCHOS has all the necessary ingredients to skyrocket in value!**

FISHING: In jewel like lakes, and mountain fed bottom streams you'll catch trophy size German Browns, Rainbow and Brook Trout . . . large mouth fighting Bass. RANCHO owners can catch their dinner within easy driving distance of the property lines.

HUNTING: Hunters from all corners of the globe come to Elko County to hunt the big game species Mule Deer . . . Quail, Chukar, and Partridge are found in abundance.

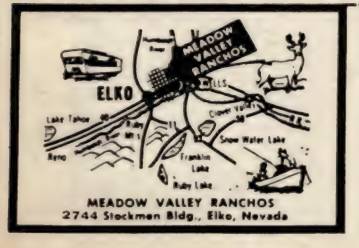
GOLF: A mere one mile from MEADOW VALLEY RANCHOS is the Ruby View Golf Course. No rush for starting times on this city owned and maintained golf course, but golfing as it should be enjoyed. Play a leisurely 9-18 or 36 holes surrounded by breathtaking scenery, minutes from your rancho.

YOUR OWN LAKE... You, and your invited guests will spend many happy hours boating, fishing and picnicking at nearby Lake Osino. There is no charge to Rancho owners for full rights to the use of this private multi-acre lake and park area.

PROVEN OPPORTUNITY: Yes, individuals are taking advantage of Nevada opportunity. But the country's leading corporations are also investing in their Nevada futures. Industrial giants, who erect plants where increasing land values and population demand them, are building or have secured acreage throughout Nevada.

LOW OR NON-EXISTENT TAXES: As a result of Nevada's low realistic tax structure, Profits And Wages Are Kept; not paid out to the state. NEVADA HAS NO STATE INCOME, INHERITANCE, CORPORATION OR GIFT TAX. The low real property tax is definitely limited by the state constitution. YES, NEVADA IS ONE OF OUR LAST FRONTIERS OF TAX FREEDOM!

TOTAL COSTS: The full price of the title to your **2½ acre Rancho is only $695.00.** Complete payment schedule is **$1.00 down and $10.00 per month.** No interest, no carrying charges. Live, Vacation or Retire on your land, or simply hold for investment security. Wise men like Andrew Carnegie said, "More money has been made in Real Estate than in all industrial investments combined." **Make MEADOW VALLEY RANCHOS' PROSPEROUS FUTURE — YOUR FUTURE. DON'T MISS THIS GOLDEN OPPORTUNITY!**



MEADOW VALLEY RANCHOS
2744 Stockmen Bldg., Elko, Nevada

MAIL COUPON TODAY

Yes! — Reserve acreage at MEADOW VALLEY RANCHOS for me — 2½ acre parcel, $695 — payable $1 down, and $10 a month, no interest, no carrying charges. Send purchase contract and map showing exact location of my holding. You will return my deposit if I request same within 30 days. Have indicated below number of Ranchos desired.

SIZE ACRES	DOWN	PER MO.
2½	$1	$10
5	$2	$15
7½	$3	$20
10	$4	$25

Name:_____

Address_____

City:_____ Zone:_____ State:_____

Indicate No. of Ranchos ____ Total enclosed $____

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Every Feature You've Ever Dreamed Of! 17 true voices, chimes, 2-speed rotating Leslie plus Main speaker systems, attack, repeat & sustain percussion, two 44-note keyboards, 13 note pedals, plus many more!
No Extras To Buy! Everything including bench at *one* price. *No* hidden necessities to add on.
Save Hundreds Of Dollars! Save $400 or more over comparable factory-built versions. Easy to assemble — no special skills needed. Easy to play, too!
Hear It Yourself! Send 50c with coupon & receive 7" 33-1/3 rpm demonstration record, plus complete details.
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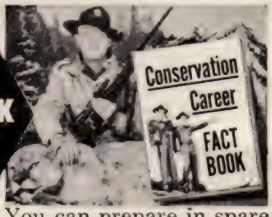

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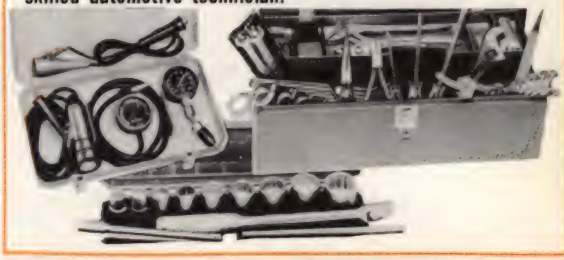

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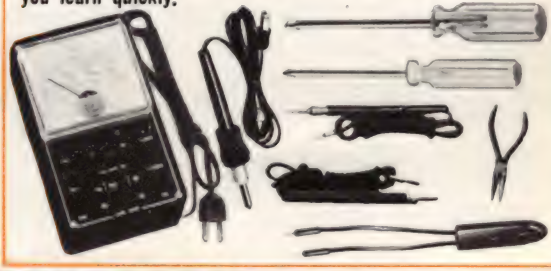

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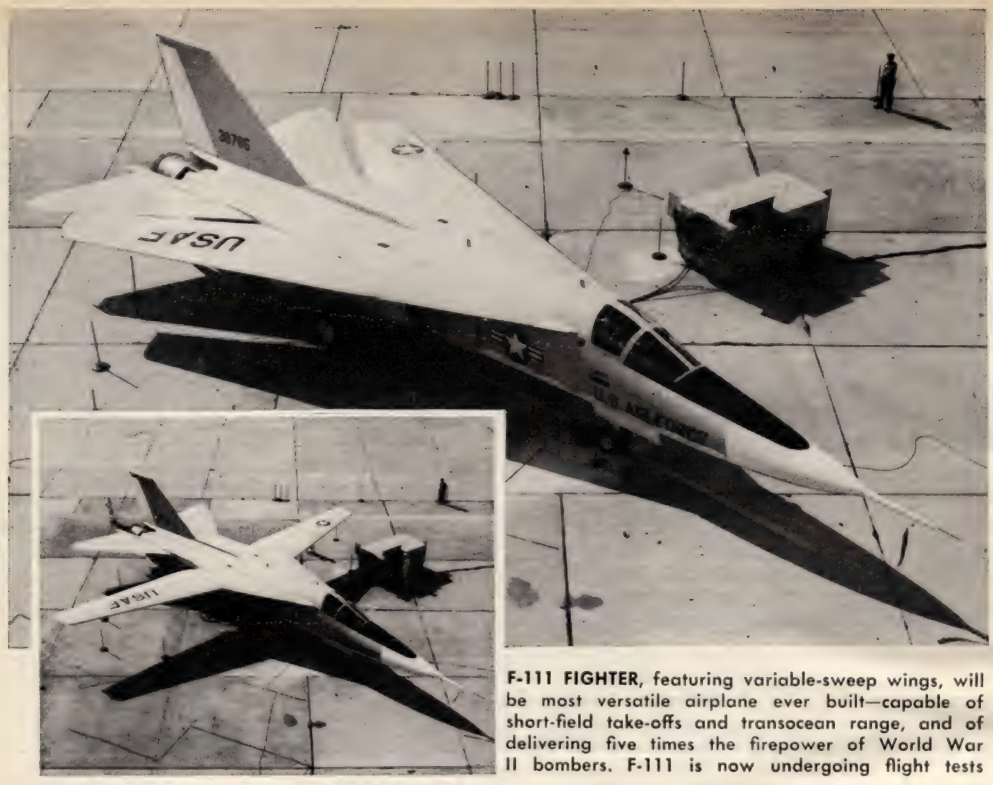

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Parts Interchange

The F-111 is the first high-performance aircraft designed for both Air Force and Navy use. The Navy version is somewhat shorter than the Air Force design, but over 80 percent of the parts are identical.

The cockpit, which holds two pilots, is a self-contained capsule; in an emergency a rocket will boost the capsule (which consists of a portion of the fuselage and wings) clear of the aircraft, and a parachute will control its descent.

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From its inception the aircraft has been embroiled in controversy—and still is. The contract was not awarded to the lowest bidder; only 1500 pounds of titanium have been used in its construction despite opinions that only titanium will be able to withstand the extreme temperatures; and it has been criticized as too heavy (about 70,000 pounds) for Navy use.

However, if the flight tests are successful the plane unquestionably will be the most versatile ever built. The Australian government has such faith in the design that it already has ordered several of the fighters, and about 1700 of the planes are expected to be produced for the two services.—*Clifford B. Hicks*

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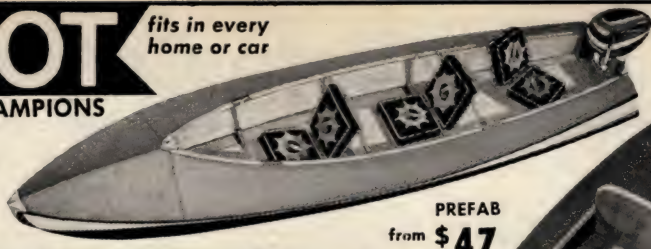

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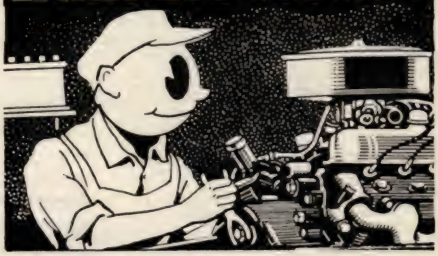

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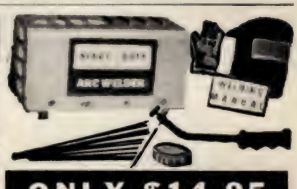

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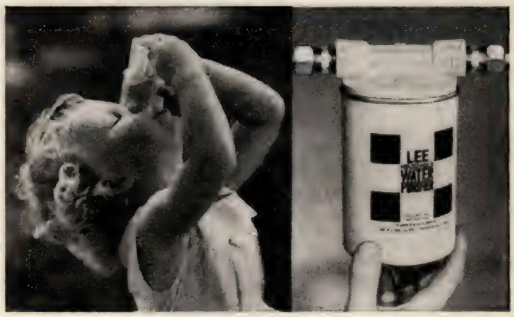

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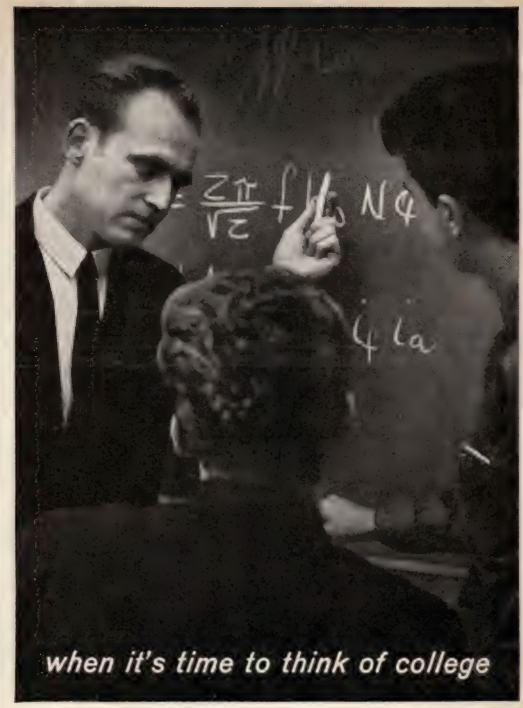

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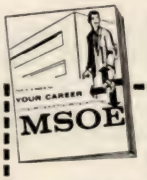

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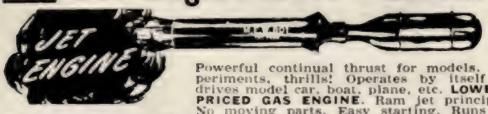

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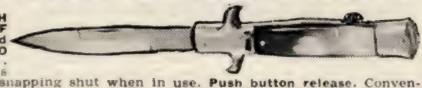

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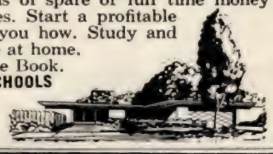

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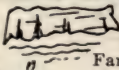

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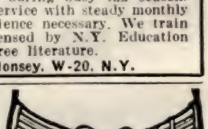

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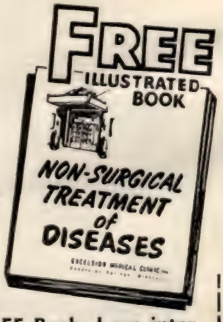

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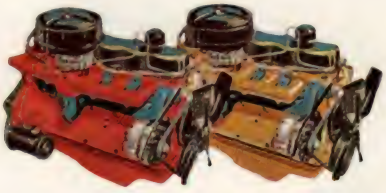

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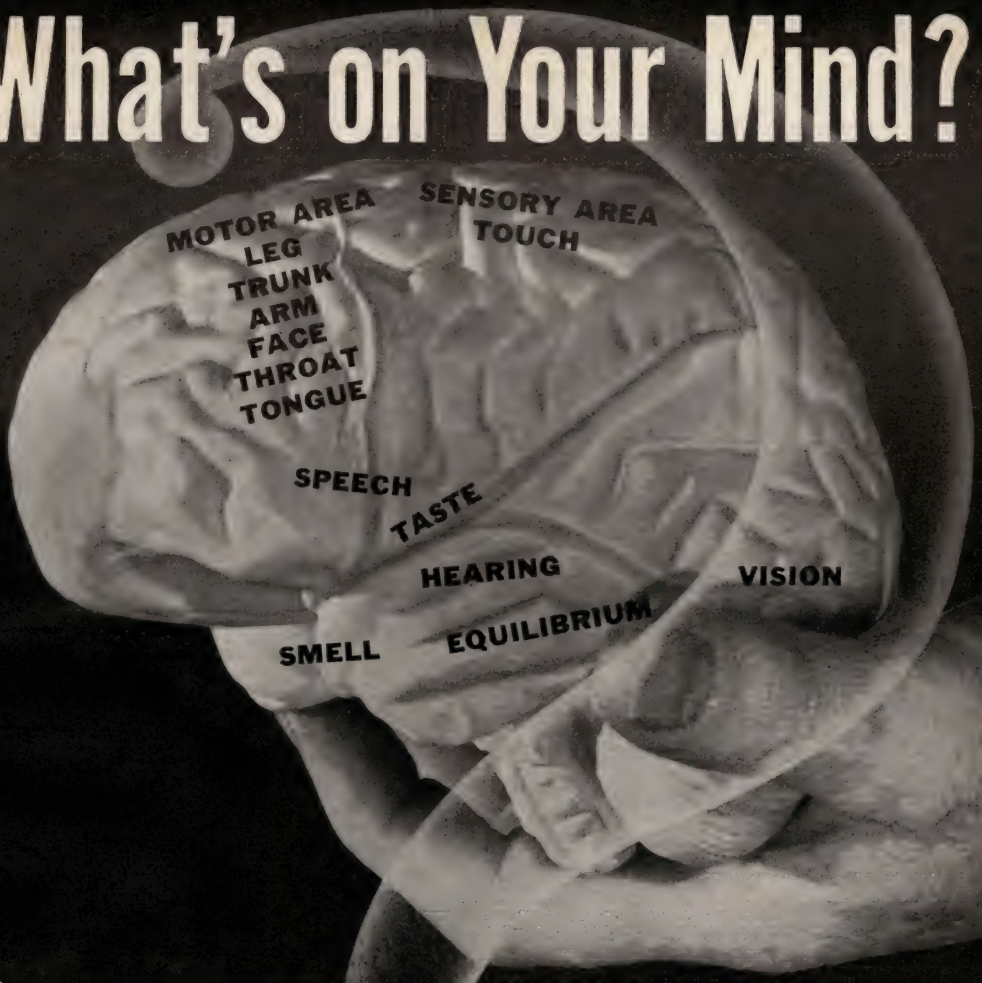


(Just 10 Million, Million Things)

Your grapefruit-sized brain stores 2½ million times more than today's most advanced computer. Science is finding new clues to how memory works

By John Pfeiffer

SUPPOSE THAT YOU sat down with paper and pencil to write out everything you remembered: names of people you know or have heard about, experiences from childhood on, plots of movies and novels, descriptions of jobs you've held, a list of your hobbies, and so on and on. This would hardly be a game worth playing, because even if you wrote 24 hours a day, you would be at it for at least several thousand years.

The brain's storage capacity has been estimated at some 10,000,000,000,000 (ten million million) units of

information. To put it another way, a full listing of the facts you can hold in your head would fill more than a million copies of *Popular Mechanics*, enough magazines to pack the shelves of a good-sized library. And that happens to be a conservative estimate!

The main memory of a large-scale computer may contain from 1,000,000 to 4,000,000 storage elements—tiny washer-shaped magnetic cores, each capable of holding one "bit," the basic unit of computer information. (A newly announced machine boasts of some 16,000,000 individual storage elements. This larger capacity is achieved by adding compact auxiliary core storage units to the computer's main memory.)

The cores together with associated equipment of a large-scale computer may occupy 60 to 70 cubic feet or roughly the space of a telephone booth. This represents an enormous advance over ENIAC, the first of the electronic computers, which was built in 1946 and required a large space to house a puny memory of some 600 bits or 17 words.

Brain Design Still Tops

But the brain is still champion when it comes to compact design. A blob of nerve tissue about the size of a pinhead can hold far more information than the memory units of any computer in existence today. In a volume of about ½₀th of a cubic foot, the brain includes ten thousand million nerve-cell elements or neurons, each of which can store an average of some 1000 bits. To put it another way, a human brain can store two and a half million times more information than can the main memory section of the most advanced computer in use today.

So far as speed of recall is concerned, the large-scale computer can retrieve a given item of information in half a millionth of a second. In contrast, the brain's retrieval time may be a second or more. But the machine has far less to "thumb through." If it contained as much information as the brain, its searching processes would take much longer.

How we manage to cram such a tremendous amount of information into a volume no bigger than that of a grapefruit is only one of the great unknowns of memory. Some of your brain cells change in a very specific way every time you register a new experience. But the nature of the changes, the nature of our built-in memory traces, continues to elude investigators at medical and biological laboratories, although recent work has provided some interesting clues.

The first stage of learning involves a kind of short-term memory. A child may look at a totally new thing, say a shoe or the letter "B," a number of times and each time represents an entirely new experience. In other words, no persisting record has been made. The experience only be-

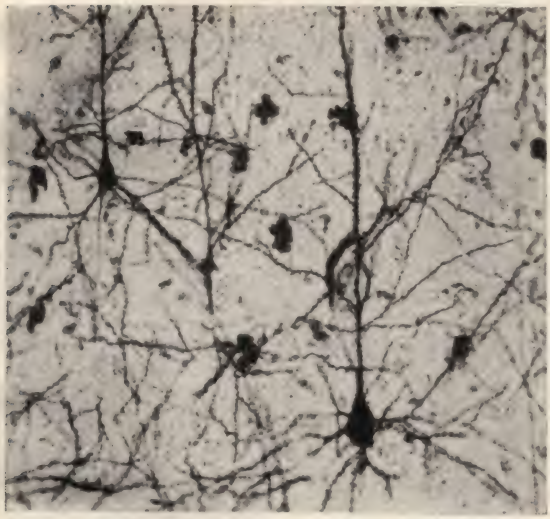
MICKEY WALKER (shown here) collected a punch to the head in his first professional bout, and took the count. Later, Walker thought he was winner

MEMORY STATISTICS
HUMAN BRAIN vs. COMPUTER

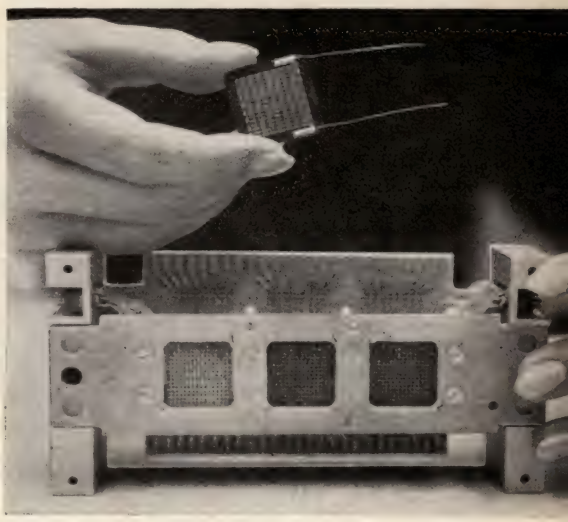
	MODERN COMPUTER	HUMAN BRAIN
Volume of memory units	60-70 cu. ft.	1/20 cu. ft.
Weight of memory units	200 lbs	3 lbs
Memory capacity (millions of bits)	1-4	10,000,000
No. of elements (millions)	1-4	10,000
Speed of recall	1/500,000 second	1 second or more

CHART COMPARES human brain, a marvel of compactness, with sprawling computer. But computer, with less information to sort, wins out in speed of recall

ARMY ALL-AMERICAN, GLENN DAVIS (shown being tackled), wondered why his team hadn't used a special play against the University of Pennsylvania. After game he asked teammate about it—and learned he had scored with it



CEREBRAL CORTEX neurons, magnified 50 times, intertwine in complex fashion. From base of each cell (dense area) stream net of communication lines



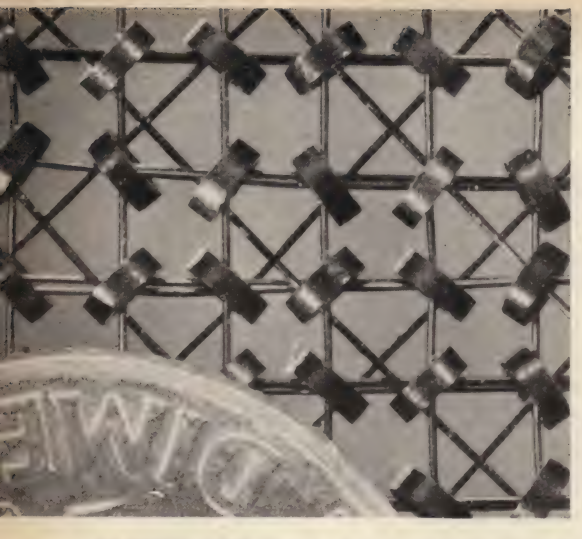
"BRAIN CELL" that provides "memory" in all-electronic phone system newly developed by Western Electric is a wafer-thin, one-inch-square ferrite plate

gins to "take" after the child has viewed the object on and off for a total of about 15 minutes—and even then the record may fade overnight. To store something permanently in the voluminous archives of the mind—a process known as consolidation—demands a longer time exposure, of 12 or more hours.

Temporary disorders of short-term memory are fairly common. Drinking too much seems to interfere with the formation of new traces, and the morning after may find us without any record of the night before. A blow on the head may have the same sort of effect. After his first professional fight, Mickey Walker, later welterweight and middleweight champion of the world, was showering when he called out to his second: "What round did I knock out the guy?"

"You didn't knock him out at all," the second explained. "He knocked you out. In the first round, too."

Glenn Davis, Army's all-American half-



MAGNETIC CORE section of memory plane, magnified about 10 times, in GE computer. Over 4000 of the pinhead-size cores go into a single memory plane

back, had a similar experience after the Penn game of 1946. As he left the field he asked a teammate why the California Special, a trick lateral-pass play, hadn't been used—only to learn that he had actually scored on that very play. Davis had not registered a single memory after being knocked groggy in a first-period pile-up.

The mechanisms of short-term memory may work less efficiently among older persons. The veteran who recalls the full details of battles fought 40 years ago often has difficulty remembering what happened last month or the day before yesterday. The aging brain tends to keep incomplete records of recent events, although the ability to retain important information may not be affected appreciably.

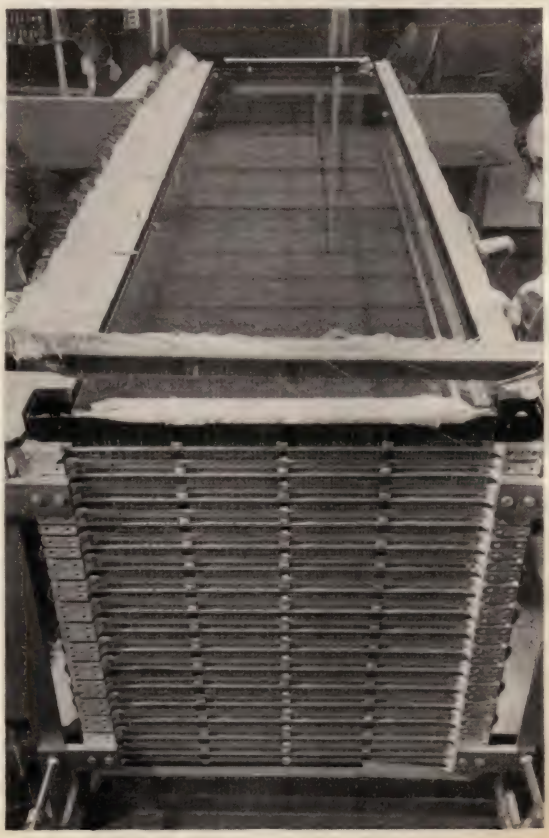
Alcoholism, on the other hand, can produce severe trouble at a relatively early age. For example, a 52-year-old taxi driver recently admitted to a Chicago hospital lives in a strange and fleeting world. He has a memory span of just about two minutes. If you tell him your name and ask him to repeat it within that period, he will have little difficulty complying. But he is sure to draw a complete blank if you make the same request after two minutes have passed. As far as this patient is concerned, two minutes ago represents a past remote beyond recall.

There is some evidence that such disorders involve a complex of nerve structures called the "Papez circuit" (after James Papez, the Cornell anatomist who speculated about its function more than 25 years ago). Buried in the depths of the brain, near the border region between the bulging cerebral hemispheres, are a number of centers arranged in a kind of loop and interconnected by nerve fibers, some of which are nearly as big around as a pencil. Damage in this region may interfere with our ability to form and store memory traces, records of the past.

Research also indicates that the mysterious traces may be chemicals of a very special sort.

James McConnell and his associates at the University of Michigan are probing the workings of human memory by studying the lowly flatworm, a tiny "cross-eyed" creature that can be conditioned to react to a flashing bright light. Normally, it ignores the light. But if every flash is ac-

CORE STORAGE UNITS (shown at assembly stage) can function with main memory section of new IBM computer, increasing memory power to 16,000,000 "bits"



companied by an electrical shock, the flatworm finally learns to contract sharply to the flash alone, a process that takes 150 to 200 trials.

Cut a thoroughly conditioned worm in two, and the head end grows a new tail and the tail end grows a new head. Significantly, both new worms remember most of what the original worm had learned. The investigators have also found that learning and memory are transferrable from one animal to another via cannibalistic ingestion. Under proper conditions, one worm will eat another, and the worm that has fed on his educated friend is a better learner than its brother who has had a diet solely of uneducated worms. In other words, it appears that recently acquired information has been passed from old to newborn cells. Studies at Michigan and at a number of other laboratories suggest that the information may somehow be incorporated into the structure of molecules of substances known as ribonucleic acid or RNA, for short.

RNA is an hereditary material found in all cells, including those of flatworms. Experiments performed at the University of Rochester (N.Y.) show that a "magic bullet" substance that breaks up RNA without affecting other chemicals also prevents the passing on of information from a flatworm to the creatures formed from its severed halves. In related research on rats, Swedish investigators report that learning increases the amount of RNA produced in brain cells. Not only that but it also produces changes in the chemical composition of the hereditary material, as if memory left its traces in the form of subtle alterations in the structure of giant RNA molecules, alterations that endure like symbols graven in stone.

(Please turn to page 218)

WHEN FLATWORM'S head is split down middle, each half regenerates complete head. Result: Two-headed worm learns faster than a single-headed worm does

SMART WORM takes light alley in Michigan laboratory maze to gain reward: immersion in home bowl of water. Choice of dark alley nets the worm nothing

Test Matching Three

Low-Cost Tigers

Ford's
MUSTANG
It'll win every stop-light grand prix in its class, but this horse suffers from live-axle rear wheel hop

Corvair's
CORSA
Road-holding by new suspension is worth an extra 100 hp . . . Cowl quake is typical of U.S. convertibles

Plymouth's
BARRACUDA
This highway charger takes 2+2 adults in comfort, but the exhaust note is still its top sports-car feature

How does this sinewy threesome compare? To find out, a top racing driver gave them a three-day handling, cornering and rough road wringout, topped by braking tests and an economy run

By Ed Nelson

IF YOU WANT to look, sound and act young on the road, each of the Big Three car builders is aiming a new model right at you.

Plymouth's Barracuda, Ford's Mustang, and the turbocharged Corvair Corsa may look somewhat tigerish, but which has the sharpest performance bite? Which responds best to harsh handling demands? How good are their brakes and how modest is their appetite for fuel? And, finally, how comfortable are they to live with, in relaxed as well as competitive moments?

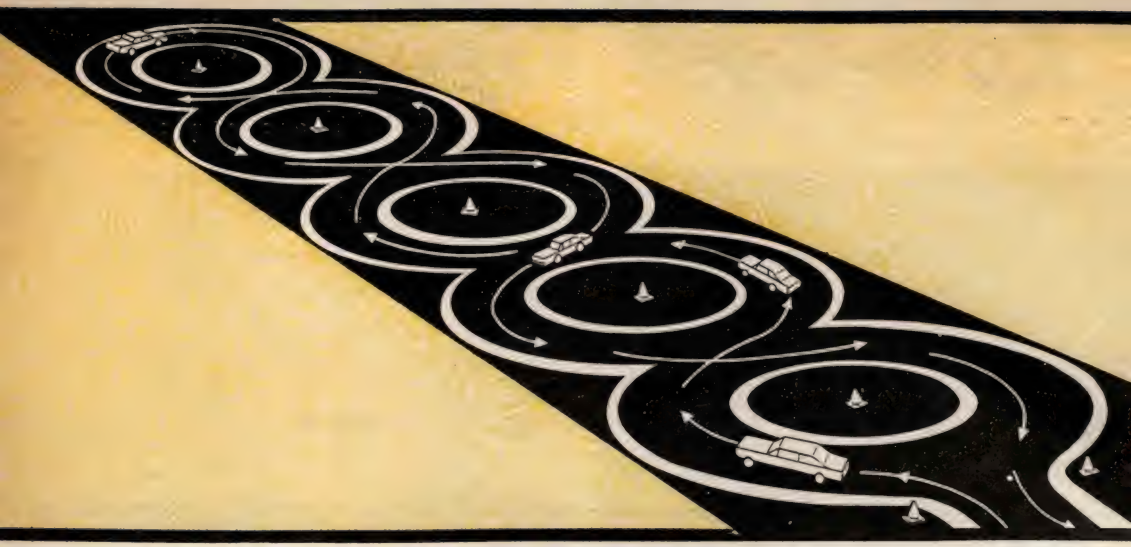
To find out, we subjected each car to a three-day series of race track acceleration and handling tests, back road runs, braking competitions and fuel mileage comparisons.

There were some surprising results. You may not have thought that the Corsa belonged in this league, and indeed it was not the tiger we had tried to get—the Corvette Sting Ray. But Sting Rays were strike-bound at the time of testing, so we obtained a Corsa instead, in full combat-ready condition. And it won its full share of the competitive events in this league.

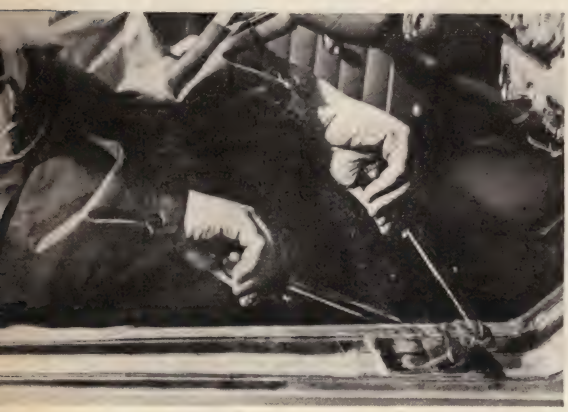
The cars. We tried for the most combat-equipped specimens to represent each make. Here's how we fared—

Corsa: 180-hp. turbocharged six. 3.55:1 rear axle. Four-speed stick shift. Telescopic steering column. New independent rear suspension. Convertible weighed in at 2863 lbs. Power-weight ratio was 15.9 lbs./hp.

Mustang 2+2: 271-hp. V8 with 11.6:1 compression ratio. 3.89:1 rear axle. Four-speed stick shift. Heavy-duty front stabilizer bar and front and rear shocks and springs. Weighed in at 3005 lbs. Power



CORSA SCOOTED THROUGH the slalom course in best average time. Mustang power was close behind, but 'Cuda fast steering couldn't compensate for heavy lean on end turn. The engine faltered; carb jets may have been uncovered



ACTION OF THE MUSTANG'S stick was pleasantly snappy. Linkage operated positively and precisely, but four-speed transmission seemed to waste a gear

CORSA'S SNUG REAR SEAT was still more spacious than Mustang's. Telescoping steering column lets you stretch your arms, but drops wheel against your legs

ACCELERATION

	Barracuda		Mustang		Corsa	
	Time	Stick Pos'n	Time	Gears	Time	Gears
0–60	9.47	Drive	8.13	1–2	10.13	1–2–3
40–60	4.12	1–2	3.65	2	5.73	2–3
			3.90	2–3		
50–70	5.25	1–2	3.75	2–3	6.80	3
			4.30	3		

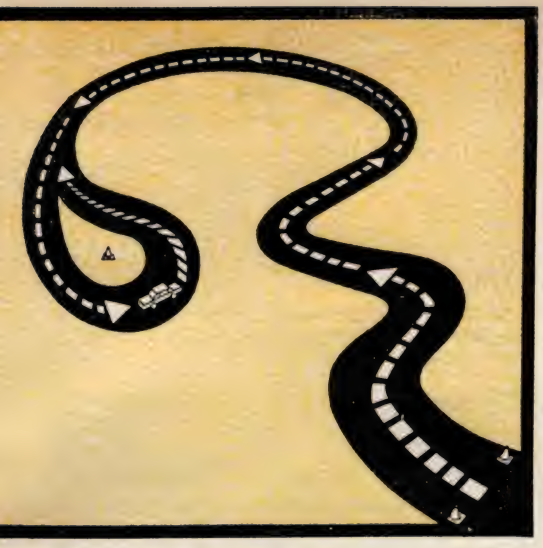
BRAKE FADE

Pedal Force, First Stop	35#	75#	60#
Pedal Force, Fourth Stop	140#	95#	103#
Effective Lining Area	156.2 sq. ins.	127.8 sq. ins.	168.9 sq. ins.

weight ratio was 11.1 lbs./hp.

Barracuda: 235-hp. V8 with 10.5:1 compression ratio. 3.23:1 rear axle. Automatic transmission (sad to say, no stick shift was available), power brakes and steering, air conditioner. Sure-grip differential. Heavy-duty springs and torsion bars. But car had no sway bar, extra-wide 14-in. wheels or special tires, normally part of "Formula S" handling package. Weighed in at 3280 lbs. Power weight ratio was 14 lbs./hp.

The driver. The cars were presented to John Fitch, road-racing professional and veteran of wheel-to-wheel battles at such international events as Nassau, Le-Mans and Sebring. He designs and builds



HANDLING COURSE took cars from the gate (foreground) to turnaround pylon and back. On return trip, the first turn is a deceptive, diminishing radius

THE BRAKING WHEEL HOP after Mustang's handling runs left this series of short skid marks on track surface. These punishing stops were hard to control

BARRACUDA, LIKE MUSTANG, gives long-load capacity by dropping its rear seat and trunk panel. Bar in foreground restrains load or latches seat upright

FUEL COMPARISON CHART (MPG.)

	Barracuda	Mustang	Corsa
Weight	3280	2996	2863
30 mph.	20.44	18.18	22.69
40 mph.	21.84	18.92	21.32
50 mph.	18.75	16.61	19.98
60 mph.	18.24	15.92	18.59
70 mph.	15.38	14.33	17.83
Caravan	18.72	15.00	20.00

AT NEARLY EVERY SPEED, including highway caravan after the tests, the little Corsa engine was the economy champ while its blower saw little service

handling and performance equipment for domestic cars—and even the VW bus. His assignment: Wring them out and tell us what you think.

The tests. For our answers, we headed for Lime Rock Park, an SCCA-sanctioned, road-racing track in Connecticut. It has over a mile of hills, twists and turns plus a ⅓-mile straightaway. We set up an acceleration course on the straight, a handling course to run at speed, and a tight slalom to evaluate steering. Back roads in Connecticut and Massachusetts let us compare behavior up steep hills, across railroad tracks, along gravel and blacktop roads. Brake fade was measured on a deserted side road. A straight, flat stretch of multi-lane highway gave us steady-speed fuel consumption. And a convoy trip for the 100-plus miles back to New York provided over-all fuel figures for general highway driving.

After bringing tire pressures on all three cars up to manufacturer's recommendations for high-speed driving, we headed for the track. And these were our findings:

Handling Course (see drawing above) —Average times for these runs were Mustang, 71.5 seconds; Corsa, 71.8 seconds; Barracuda, 79.6 seconds.

The Mustang, Fitch noted, "behaves

THE DOOR IS LATCHED SHUT, but you can still see a slice of sky through the sizable gap at this Corsa's A-pillar. Its cowl quaked some—as it does on most U.S.-built convertible body shells

SHORT BELTS HOLD 'CUDA rear seat flat. Bar latches in assembly at right to hold the seat upright, but flip it back too hard and bar can over-ride its catch

REAR SEAT HEADROOM? In Mustang's 2+2 it's almost non-existent. Barracuda headroom is better. Rear quarter louvers in the Mustang extract cigarette smoke neatly

IF YOU WANT FANCY Mustang wheel covers, be sure to insist on getting extra long valve stems. Otherwise you'll have big trouble checking or adding air pressure

more than decently—almost like a good road-racing car within the limits of its weight and type. There's one outstanding exception: the rear wheel hop. On acceleration and—more out of place—on braking, the leaf springs wind up, then unwind with a bang and jump the wheel off the ground. When it comes down the process repeats. In a hard stop, this shuddering puts the car out of control."

While Ford, John suggests, controls the live axle with stiff springing and accepts the rougher ride penalty, Barracuda designers compromise with softer springs and avoid the axle tramp. "But you don't get something for nothing."

The Barracuda's time was slower because of the trouble in controlling the car. Fitch said: "There was severe bottoming through these turns; body roll takes up all the suspension travel and there's practically no jounce room left. It wallows and thumps quite severely." This is just the behavior that the sway bar, when it's installed, should prevent. Our 'Cuda had 57 percent of its weight on the front wheels.

Coming back to the starting gate for a hard stop, we found there was so little weight on the 'Cuda's rear wheels that they locked up quickly. In Fitch's words, "to get through the gate and stopped, I had to let off on the brakes and keep the rear end from sliding around. Maybe with five in the car, this braking effort is right. For two in front it isn't very efficient."

Although it gave away 89 hp., the Corsa came within 0.3 second of Mustang's average time. And Fitch commented, "It doesn't bottom . . . has a pleasant, manageable drift. It's a real pleasure to push a stock American car through medium to fast bends in an easily controlled drift. A few years ago no-one would have predicted Detroit could—or would—produce such a vehicle, but it's real."

The parallelogram linkage from the Corsa independent rear gets the credit for the new controllability. Fitch pointed out, "Before this year, *the* characteristic of

(Please turn to page 228)

1965 CALENDAR OF AUTOMOTIVE EVENTS

JANUARY

Jan. 2-11	Indianapolis Fairgrounds Auto Show
Jan. 10-12	Fort Worth, Tex., Auto Show
Jan. 16-23	Monte Carlo Rally
Jan. 17	Riverside 500 NASCAR Race (T)
Jan. 23-27	Pure Oil Performance Tests, Daytona, Fla.
Jan. 24	Phoenix, Ariz., USAC Int'l Stock-Car Race (T)

Pure Oil Braking Test ▶

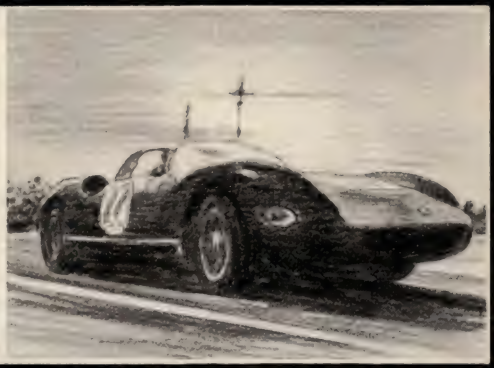
FEBRUARY

Feb. 4-7	Winternationals NHRA Drags and Custom Fair (show), Pomona, Calif.
Feb. 14	Daytona 500 Int'l NASCAR Race (T)
Feb. 20-23	Chicago Auto Show
Feb. 27-28	Oakland, Calif., Roadster Show (hot rods and customs)
Feb. 27-28	Autorama Hot Rod and Custom Show, Hartford, Conn.
Feb. 28	Daytona Continental SCCA Race (GT, PT, S, T)

◀ *Daytona 500-Mile Race*

MARCH

Mar. 7	Richmond, Va., NASCAR N/O Race (T)
Mar. 16-19	Central African Rally
Mar. 21	N. Wilkesboro, N.C., NASCAR N/O 250 Race (T)
Mar. 27	Sebring SCCA 12-Hour Int'l Ch Race (GT, PT)
Mar. 28	Bristol, Tenn., NASCAR N/O Race (T)
Mar. 28	Phoenix, Ariz., USAC 150 Race (Ch)



Sebring ▶

APRIL

Apr. 3-11	Internat'l Auto Show, NYC
Apr. 4	Atlanta, Ga., NASCAR N/O Race (T)
Apr. 5-?	Mobil Economy Run
Apr. 15-19	East African Safari Rally
Apr. 20-24	Tulip Rally, Holland
Apr. 25	Martinsville, Va., NASCAR N/O Races (T)
Apr. 25	Trenton, N.J., USAC 100 Race (Ch)

◀ *Mobil Economy Run*

1965 CALENDAR OF AUTOMOTIVE EVENTS

MAY

May 2	Yankee 300 NASCAR Race (T)
May 3	Laguna Seca, Calif., SCCA Races (GT, S)
May 8	Darlington, S.C., NASCAR N/O Race (T)
May 9	Targa Florio Grand Prix, Sicily
May 10	Pacific Raceway SCCA Races, Kent, Wash. (GT, S)
May 14-17	Rally Acropolis, Greece
May 23	Charlotte, N.C., NASCAR N/O Race (T)
May 23	Nurburgring, Germany, Race (GT, PT)
May 31	Indianapolis 500 USAC Race (Ch)

Indianapolis 500 ▶

JUNE

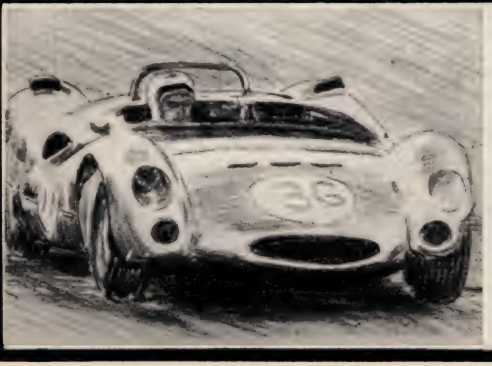
June ?	Phoenix, Ariz., AHRA Drag Racing Championship
June 6	Milwaukee, Wis., USAC 100 Race (Ch)
June 13	Atlanta, Ga., NASCAR N/O 400 Race (T)
June 13	Belgian Grand Prix
June 19-20	LeMans 24-Hour Race, France
June 20	Langhorne, Pa., USAC 100 Race (Ch)
June 22	Plymouth Trouble-Shooting Contest, Detroit
June 27	Italian Grand Prix, Monza
June 28	Watkins Glen SCCA Race (GT, S)

◀ *Plymouth Trouble Shooting Contest*

JULY

July 4	Pikes Peak Hill Climb, USAC
July 4	Daytona Firecracker NASCAR Race (T)
July 11	Bridgehampton, N.Y., NASCAR N/O Race (T)
July 13	Atlanta. Ga., NASCAR N/O 400 Race (T)
July 18	Trenton, N.J., USAC 150 Race (Ch)
July 19-25	Alpine Rally, France
July 25	Hoosier Grand Prix, Int'l Ch (C)
July 25	Oregon Nat'l Raceway SCCA N/O Races (GT, PT, S, Jr)
July 25	Bristol, Tenn. NASCAR N/O Race (T)

Pikes Peak Hill Climb ▶



AUGUST

Aug. 9	Meadowdale SCCA Race, Carpentersville, Ill. (S, GT)
Aug. 14-16	Berkshire SCCA Rally
Aug. 15-16	NHRA Divisional Drags, Pomona, Calif.
Aug. 21	Springfield, Ill., USAC 100 Race (Ch)
Aug. 22	Milwaukee 200 USAC Race (Ch)
Aug. 23	Watkins Glen, N.Y., SCCA Race
Aug. 25-29	Spa-Sofia-Liege Rally, Belgium
Aug. 28	Portuguese Grand Prix
Aug. 30	Mid-Ohio SCCA Race, Mansfield (GT, S)

◀ *Watkins Glen SCCA Races*

1965 CALENDAR OF AUTOMOTIVE EVENTS

SEPTEMBER

Sept. 2-6	Nat'l Championship NHRA Drags and Custom Show, Indianapolis
Sept. 6	Darlington, S.C., NASCAR Race (T)
Sept. 6	AHRA Drag Championships, Texas
Sept. 11-12	Old Car Festival, Dearborn, Mich.
Sept. 12	Richmond, Va., NASCAR N/O Race (T)
Sept. 18	Hoosier 100 USAC Race, Indianapolis (Ch)
Sept. 18-19	Bridgehampton, N.Y., SCCA Int'l Ch Races (S, PT, T)
Sept. 26	Martinsville, Va., NASCAR N/O Race (T)
Sept. 26	Trenton, N.J., USAC 200 Race (Ch)

NHRA National Drags ▶

OCTOBER

Oct. 3	Watkins Glen, N.Y., SCCA Int'l Ch Grand Prix (F1)
Oct. 3	N. Wilkesboro, N.C., NASCAR N/O 250 Race (T)
Oct. 9-10	Riverside, Calif., SCCA Int'l Ch L.A. Times Grand Prix (S, GT)
Oct. 16	Lime Rock, Conn., SCCA Nat'l Races (S, GT, PT)
Oct. 16-17	Laguna Seca, Monterey SCCA Int'l Ch Grand Prix (GT, S, Jr)
Oct. 25	Mexican Grand Prix, (F1)
Oct. 29-31	El Camino Real Rally, Calif.

◀ *October—usual last month, Bonneville, Utah, speed runs (depending on salt)*

NOVEMBER

Nov. 1	Phoenix, Ariz., SCCA Race (GT, S)
Nov. 5-7	Appalachian Rally, Philadelphia
Nov. 6	Nine-Hour Endurance Race of Kyalami, S. Africa (T, GT)
Nov. 13	Great Britain Rally
Nov. 16-21	Denver Auto Show
Nov. 21	Sandown Park Race, Australia (T)
Nov. 21	Phoenix, Ariz., USAC 200 Race (Ch)
Nov. 24-29	Portland, Ore., Auto Show
Nov. 26-28	Golden West Rally, San Francisco
Nov. 27-Dec. 6	Bahamas Speed Week (S, GT, FV)

Appalachian Rally ▶

DECEMBER

◀ Dec. 11 Bahamas Speed Weeks (see November)

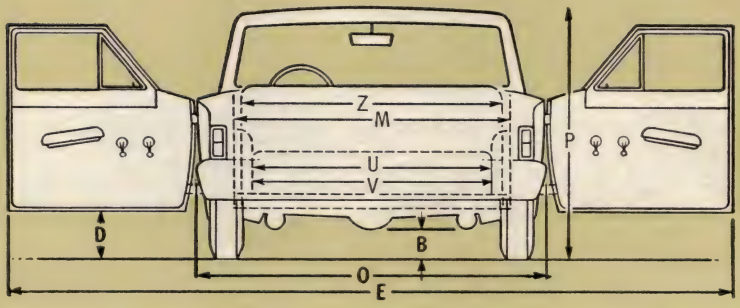
Dec. 11 Rand Grand Prix, S. Africa (F 1, 2, 3)

KEY TO ABBREVIATIONS:

AHRA—American Hot Rod Association
C—Formula Libre (including Indy cars)
Ch—Championship Indy type cars
F1—Formula 1
FV—Formula Vee (VW running gear, F1 bodies)
GT—Grand Touring
Int'l Ch—International Championship
Jr—Formula Junior
NASCAR—National Association for Stock Car Auto Racing
NSRA—Nation Hot Rod Association
N/O—National Open
PT—Prototype
S—Sports
SCCA—Sports Car Club of America
T—Touring (including stock cars)
USAC—US Auto Club

SOME DATES AND LOCATIONS STILL TENTATIVE

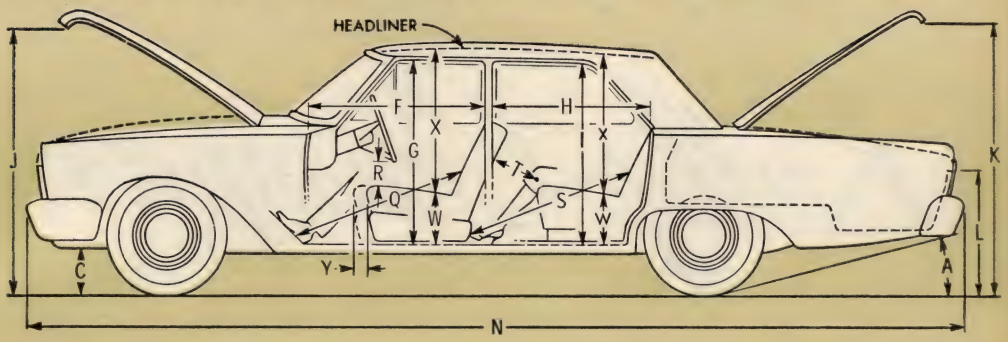
Comfort-Livability



	A		B	C	D	E	F-G	H-I	J	K	L	M		
	Max. driveway departure angle°	Max. depth doorsill to floor	Min. road clearance	Min. front-end curb clearance	Open-door curb clearance	Open-door wingspread	Front-door opening horizontal x vertical	Rear-door opening horizontal x vertical	Head clearance under hood	Head clearance under trunk lid	Luggage lifting height	Trunk-opening width	Usable luggage capacity, cu. ft.	Standard steering ratio
Ambassador	14.2	4.2	6.0	7.0	15.2	142.4	35.0x37.0	34.0x36.5	71.0	64.5	21.7	49.7	15.2	28.4
American	18.0	4.5	6.0	14.0	14	137.1	43.0x37.0	37.0x36.0	63.2	63.5	26.1	45.2	12.0	29.0
Belvedere	15.5	4.0	5.1	12.0	16.5	142.2	41.0x37.1	40.9x37.1	67.5	68.2	26.9	54.5	17.3	28.7
Barracuda (2-Dr.)	13.9	5.5	5.4	7.2	13.7	150.5	42.5x36.5	DNA	69.7	50.0	24.7	48.7	5.7S	28.7
Buick	16.2	0.5	5.6	13.2	13.4	148.5	34.0x37.5	30.0x37.5	72.0	74.0	29.4	58.0	19.2	33.2
Cadillac	11.0	0.5	5.5	12.0	12.5	148.9	28.0x38.0	28.0x38.0	75.0	77.0	27.2	57.0	17.1	18.2P
Chevelle	14.0	1.5	4.9	13.0	13	134.2	32.0x36.5	30.0x36.5	73.0	73.5	20.6	50.5	16.8	28.1
Chevrolet	13.0	2.0	5.3	13.5	13	143.7	34.0x37.5	30.0x37.5	74.5	78.0	24.6	66.0	17.7	28.2
Chevy II	17.0	1.0	5.2	14.0	13.5	134.0	32.0x37.5	31.0x37.5	69.0	60.0	21.0	49.0	13.0	25.4
Chrysler	11.2	2.0	5.4	10.0	15.5	152.6	36.0x37.5	27.0x38.0	72.0	72.0	27.6	55.0	16.5	15.7P
Classic	13.8	4.0	6.0	14.0	15	142.4	34.5x36.0	33.0x36.0	67.0	60.0	21.2	49.5	15.2	28.4
Comet	13.4	2.5	5.9	13.5	14	135.3	33.2x36.8	35.8x36.4	73.0	70.0	29.2	58.0	13.5	27.1
Coronet	13.7	2.5	5.1	13.0	16.5	142.2	31.0x37.0	29.0x37.0	68.0	62.0	27.0	53.0	16.7	28.7
Corvair	20.0	4.2	5.4	14.0	13.5	131.3	30.7x35.0	28.2x35.0	76.5	69.0	27.6	53.5	7.0	23.3
Corvette (2-Dr.)	17.3	4.0	5.0	12.0	13	139.3	35.5x33.5	DNA	67.0	DNA	DNA	DNA	10.6	20.2FS
Dart	12.7	2.5	5.5	11.0	14	139.2	33.0x36.0	27.0x36.0	70.5	65.0	21.7	46.0	17.3	28.7
Dodge	13.3	1.2	5.8	10.0	13	152.6	33.0x37.0	26.2x37.0	72.0	68.0	24.6	49.7	17.1	28.7
F-85	15.3	1.0	5.5	12.5	13	134.0	31.5x36.0	30.0x36.0	72.0	73.5	30.1	51.25	20.1	28.3
Fairlane	13.1	2.7	5.4	13.5	15	138.1	30.0x38.0	33.8x38.0	71.0	69.0	30.7	50.0	15.0	27.8
Falcon	16.1	3.5	5.6	13.0	13.7	135.3	33.3x36.7	33.7x36.5	72.0	62.0	27.2	47.5	12.2	27.0
Ford	11.9	2.0	5.5	13.0	12.2	144.3	43.0x38.0	27.0x37.0	73.0	64.0	23.0	49.0	19.1	30.9
Imperial	11.1	1.0	5.4	12.5	16	154.0	39.0x37.5	27.0x37.5	73.0	69.0	29.8	59.0	17.8	15.7P
Lincoln	11.8	3.0	5.2	11.0	12	147.1	33.7x37.0	33.0x37.0	80.0	67.7	24.0	67.0	15.5	20.5P
Mercury	13.7	0.5	5.9	13.5	14	145.6	31.0x37.0	25.0x37.0	72.0	65.0	24.4	56.0	18.6	31.1
Mustang (2-Dr.)	16.7	6.0	5.2	11.0	14	150.2	42.5x32.5	DNA	77.0	50.5	27.7	50.7	8.9	27.0
Oldsmobile	13.1	1.0	5.7	15.0	14	143.8	33.0x37.0	31.0x37.0	79.0	74.0	27.9	53.0	19.4	33.3S
Plymouth	11.1	1.5	5.7	13.0	15	152.6	38.8x36.8	36.6x36.8	72.0	73.0	20.0	54.5	16.8	28.7
Pontiac	12.4	1.0	5.6	11.0	13	143.9	39.0x36.5	29.0x36.5	71.0	72.0	29.0	53.0	19.2	28.2
Riviera (2-Dr.)	16.5	2.0	5.6	12.7	13	155.2	48.0x37.0	DNA	77.0	78.5	28.4	58.0	10.2	19.0P
Special	14.7	2.0	5.4	13.5	13.2	134.1	31.0x36.0	28.5x36.0	72.0	74.0	30.4	55.0	16.1	28.6
Tempest	13.4	1.0	5.4	12.0	13	134.0	31.6x36.2	30.0x36.0	70.0	71.5	27.2	53.0	21.2	28.3
Thunderbird (2-Dr.)	12.9	4.5	5.5	9.7	12	171.2	43.5x37.0	DNA	67.0	65.0	27.1	65.0	11.5	20.4P
Valiant	14.1	2.5	5.6	10.0	15	139.2	41.1x36.7	33.7x36.7	67.5	65.2	21.2	50.2	14.1	28.7

DNA Does not apply P Power steering standard S Security panel down, 14.1 PS Power seat, 5

Index to the 1965 Cars



N-O-P				Q	R	S	T	U	V	W	X	Y	Z	
Over-all length x width x height	Turning circle, curb-to-curb, ft.	Wheel turns lock-to-lock	Wheelbase	Max./min. front legroom	Min. steering wheel thigh clearance	Min. rear legroom	Min. rear kneeroom	Front-seat hiproom	Rear-seat hiproom	Seat height front/rear	Headroom, front/rear	Front-seat travel	Min. shoulder room	Glove box depth x opening width x opening height
200.0x74.5x54.98	39.2	6.0	116.0	41.0/35.0	4.0	37.6	5.0	60.2	60.1	10.6/11.7	38.8/37.0	6.0	57.8	6.2x15.0x6.2
177.3x68.6x54.5	36.0	6.0	106.0	41.0/35.0	3.8	36.5	3.8	57.2	57.1	10.0/11.7	38.8/37.0	6.0	54.8	5.0x13.0x7.0
203.4x75.6x54.9	40.8	5.3	116.0	41.9/37.4	3.9	36.6	4.4	60.8	61.0	8.1/11.0	39.1/38.4	4.5	57.5	7.0x16.5x4.2
188.2x70.1x53.8	37.1	5.3	106.0	40.6/36.1	3.1	31.1	1.0	56.9	56.4	7.8/10.3	38.5/36.7	4.5	54.2	6.1x10.7x4.9
216.9x80.0x55.2	39.7	5.8	123.0	42.2/37.4	4.2	39.0	5.6	63.7	62.9	8.5/11.6	38.9/37.7	4.8	61.4	6.0x12.0x5.2
224.0x79.9x55.6	44.7	3.7P	129.5	41.1/36.3	3.5	40.9	8.0	63.5	62.6	8.5/11.3	39.5/38.4	4.8	60.9	10.0x12.0x5.5
196.6x74.6x53.2	41.9	5.5	115.0	42.0/38.0	4.2	36.3	3.6	59.9	59.8	8.1/10.8	38.6/37.3	4.0	58.8	9.5x16.5x5.0
213.0x79.6x55.4	40.8	5.4	119.0	42.2/37.4	4.2	39.5	5.7	63.8	62.8	9.0/12.0	39.1/37.8	4.8	61.4	10.0x15.5x5.0
182.9x69.9x55.0	38.4	4.5	110.0	40.1/36.1	4.3	36.1	4.2	59.2	58.9	9.0/11.0	39.0/37.6	4.0	55.3	6.2x11.2x5.0
218.2x79.5x56.4	44.0	3.5P	124.0	42.0/37.5	4.3	39.8	6.8	63.3	63.4	8.9/11.4	38.5/37.9	4.5	60.0	8.0x13.0x4.0
195.0x74.5x54.4	37.0	6.0	112.0	41.0/35.0	4.0	37.6	5.0	60.2	60.1	10.0/11.7	38.8/37.0	6.0	57.8	5.0x15.0x7.0
195.0x72.9x55.1	40.0	4.6	114.0	41.8/36.8	4.0	35.5	3.8	57.1	56.6	11.4/14.1	38.4/36.9	5.0	55.0	7.0x13.2x5.5
204.2x75.0x54.9	41.1	5.3	117.0	41.9/37.4	3.9	36.6	4.4	60.8	61.0	8.1/11.0	39.1/38.4	4.5	57.5	7.2x15.5x4.0
183.3x69.7x51.2	35.2	4.7	108.0	41.1/37.1	3.1	35.4	3.1	56.1	56.1	7.4/10.3	37.6/36.4	4.0	54.3	9.0x15.2x4.5
175.1x69.2x49.6	39.9	3.4FS	98.0	42.7/38.7	4.5	DNA	DNA	50.9	DNA	3.9/DNA	37.0/DNA	4.0	48.4	6.5x16.5x8.0
196.4x69.8x53.5	38.6	5.3	111.0	40.7/36.2	3.0	35.6	4.5	56.9	57.0	8.0/11.6	38.2/37.2	4.5	54.0	6.0x11.0x5.0
212.3x79.0x56.3	43.4	5.3	121.0	42.0/37.5	4.3	40.8	7.4	63.3	63.4	8.8/11.8	39.3/38.5	4.5	60.0	6.2x11.0x5.5
204.4x73.8x54.5	41.0	5.6	115.0	41.4/37.4	3.4	36.0	3.5	59.9	59.8	8.7/10.8	38.2/37.3	4.0	58.8	8.0x10.0x7.3
198.4x73.8x55.8	40.2	4.7	116.0	42.2/37.2	4.0	37.5	4.8	58.4	58.6	10.3/11.7	38.1/37.9	5.0	57.0	8.0x12.7x6.0
181.6x71.6x54.5	38.8	4.6	109.5	41.8/36.8	4.0	34.1	2.4	57.1	56.6	9.3/11.4	38.4/37.1	5.0	55.0	7.0x13.5x5.5
210.0x77.3x55.6	41.0	5.8	119.9	41.4/35.9	4.0	37.8	4.8	62.6	62.7	9.0/11.4	38.9/37.7	5.5	59.9	5.5x13.2x6.0
227.8x80.0x57.1	47.5	3.5P	129.0	41.6/36.6	3.7	41.5	8.6	61.0	62.0	8.2/11.3	39.3/38.7	5.0	62.0	3.5x15.0x5.0
216.3x78.6x54.2	45.7	3.8P	126.0	41.1/37.1	3.9	40.5	7.8	62.3	62.4	9.2/10.5	39.0/38.4	4.0	59.3	8.0x12.5x7.0
218.4x79.6x56.0	44.5	5.3	123.0	41.4/37.4	4.0	37.8	4.8	62.6	62.7	10.3/14.1	38.9/37.7	4.0	59.9	8.0x13.0x5.5
181.6x68.2x51.1	38.9	4.6	108.0	42.1/37.2	3.6	29.2	0.0	54.7	50.9	7.8/9.9	37.4/35.6	4.9	50.9	7.5x14.5x4.5
216.9x80.0x55.5	43.6	5.5	123.0	41.4/36.6	4.0	39.2	5.2	63.7	62.8	8.5/11.7	38.8/37.8	4.8	61.4	7.0x15.5x4.5
209.4x78.0x56.9	42.7	5.3	119.0	42.0/37.5	4.3	38.6	5.6	63.3	63.5	8.8/11.4	39.0/38.2	4.5	60.0	9.0x15.0x5.0
214.6x79.6x55.2	42.8	5.0	121.0	42.8/38.0	4.7	38.6	4.4	63.7	62.8	9.0/11.9	38.6/37.7	4.8	61.3	8.5x14.0x4.0
208.0x76.6x53.0	43.6	3.4P	117.0	40.1/35.3	2.9	34.7	2.6	62.3	53.8	7.5/10.6	38.0/37.4	4.8	55.8	7.0x11.7x4.5
203.4x73.6x54.0	40.6	5.6	115.0	41.1/37.1	3.4	35.8	3.7	59.9	59.9	8.7/10.5	38.2/37.2	4.0	58.8	7.0x10.5x4.7
206.1x73.1x54.0	43.4	5.0	115.0	41.1/37.1	3.7	36.5	3.6	59.9	58.8	8.7/10.5	38.0/37.2	4.0	58.8	6.0x12.0x4.0
205.4x77.3x52.5	40.2	3.6P	113.0	39.7/35.7	3.2	33.2	2.7	59.7	49.9	10.7/9.6	37.4/37.6	4.0PS	54.0	4.5x5.7x9.5
188.2x70.1x54.4	37.1	5.3	106.0	40.7/36.2	3.0	34.2	3.1	56.9	57.0	8.0/11.6	38.2/37.2	4.5	54.2	6.0x11.0x5.2

FS Fast steering, 17.6:1, 2.92 turns All dimensions for four-door sedans, in inches, unless otherwise noted

PARADE OF FAMOUS

Rally Champions

THE idea of a rally is to drive from point A to point B within a specified time. Checkpoints along the way keep contestants from taking short cuts.

Sound like a dry exercise in map reading? Don't say it too loudly, or some rally buff may clobber you with his "pepperpot" calculator. Or, even worse perhaps, his favorite selection of hair-raising rally anecdotes.

He'd have a point, though. A rally is indeed the most adventuresome form of competition driving.

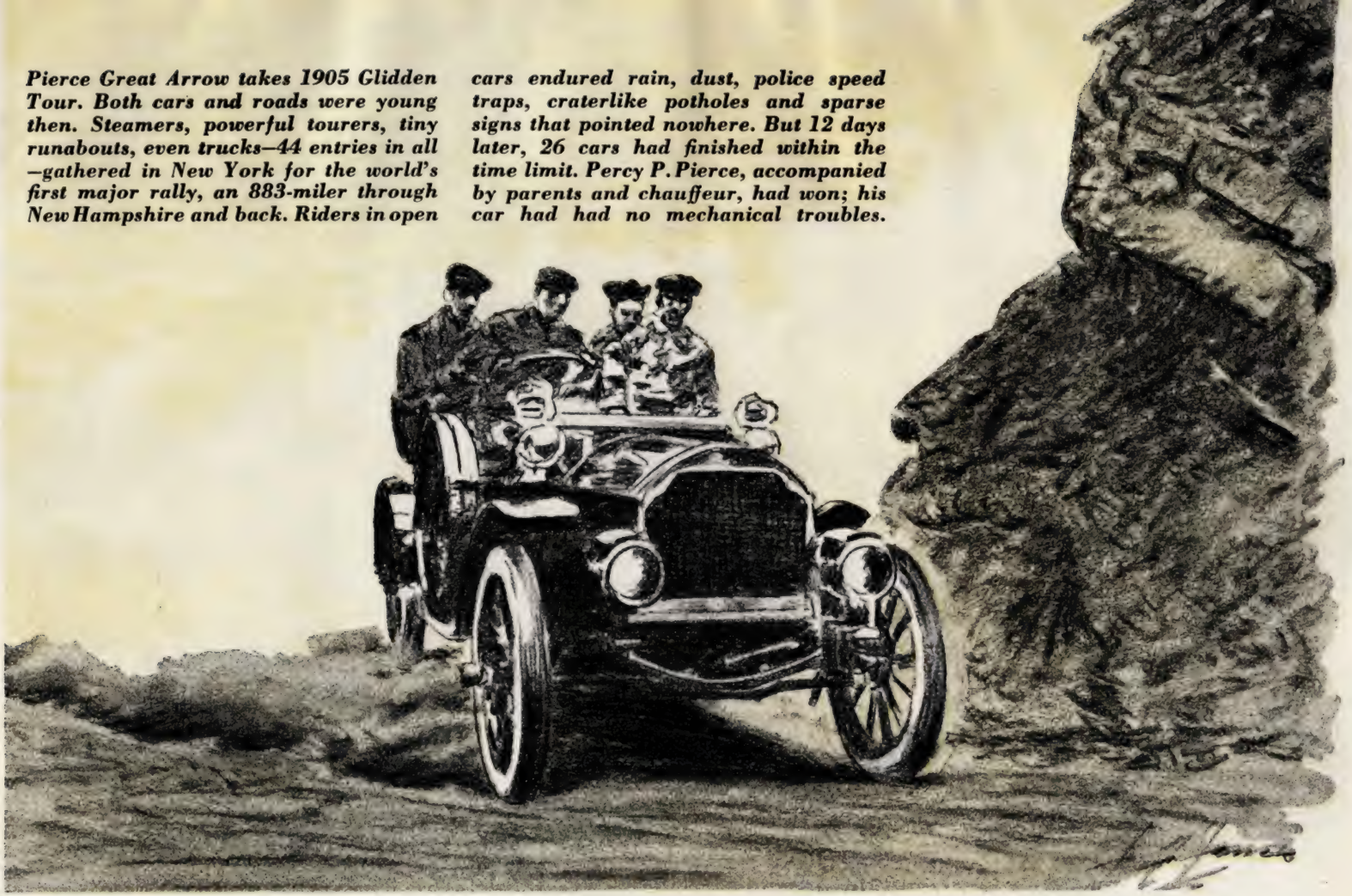
Whether it's tickling the edge of a precipice with a hard drift around a mountain hairpin, clawing or slithering through snow or hub-deep mud, ramming a chattering suspension through a choice collection of potholes—or just that queasy, bottomless feeling when you ford a stream of unknown depth—the unexpected is ever present.

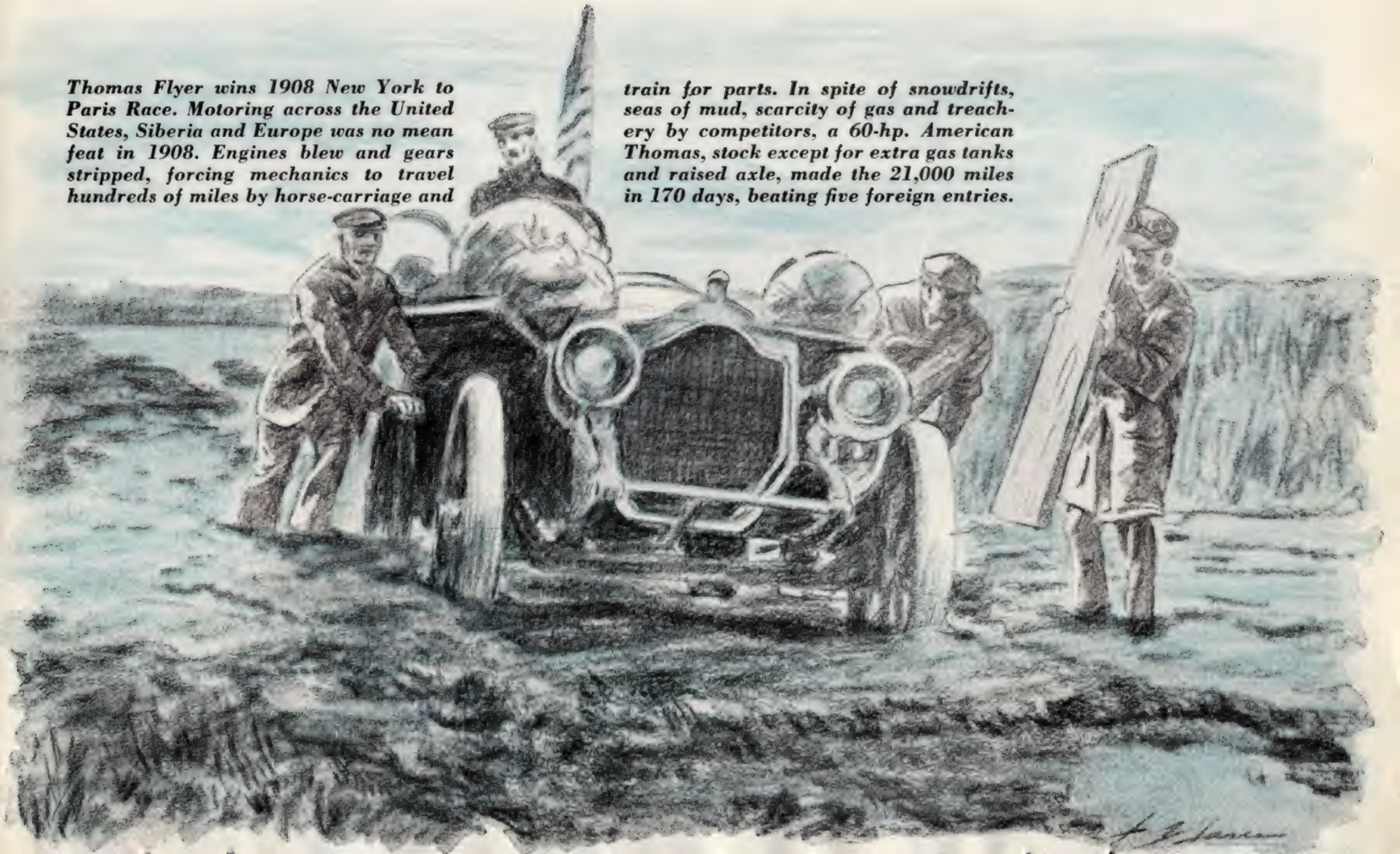
Though both cars and rallies have changed much in the last 60 years, nerve-grinding drama has always been there. Back in 1905, the Glidden Tour was a sweaty scramble with penalty points for breakdowns as well as for lateness. (Now, alas, it's a sedate tour for restored relics along well-paved roads.) Today, to find a rally that approximates the destruction-derby conditions of the 1908 New York to Paris Race, you'd probably pick the East African Safari, complete with rock throwing natives. One big thriller of recent years was the annual Carrera Panamericana. It was called a rally mainly to satisfy the authorities along the route, but it was actually closer to a flat-out race.

Although many U.S. rallies today tend to be primarily exercises in navigation, the spin-outs and the possibility of getting lost are there. Major foreign contests are more like races. But tougher. Brinkmanship speed driving, impossible weather and road conditions, and insufficient time for food and rest challenge the skill of the drivers, the racing roadability of their cars—and the stamina of both.

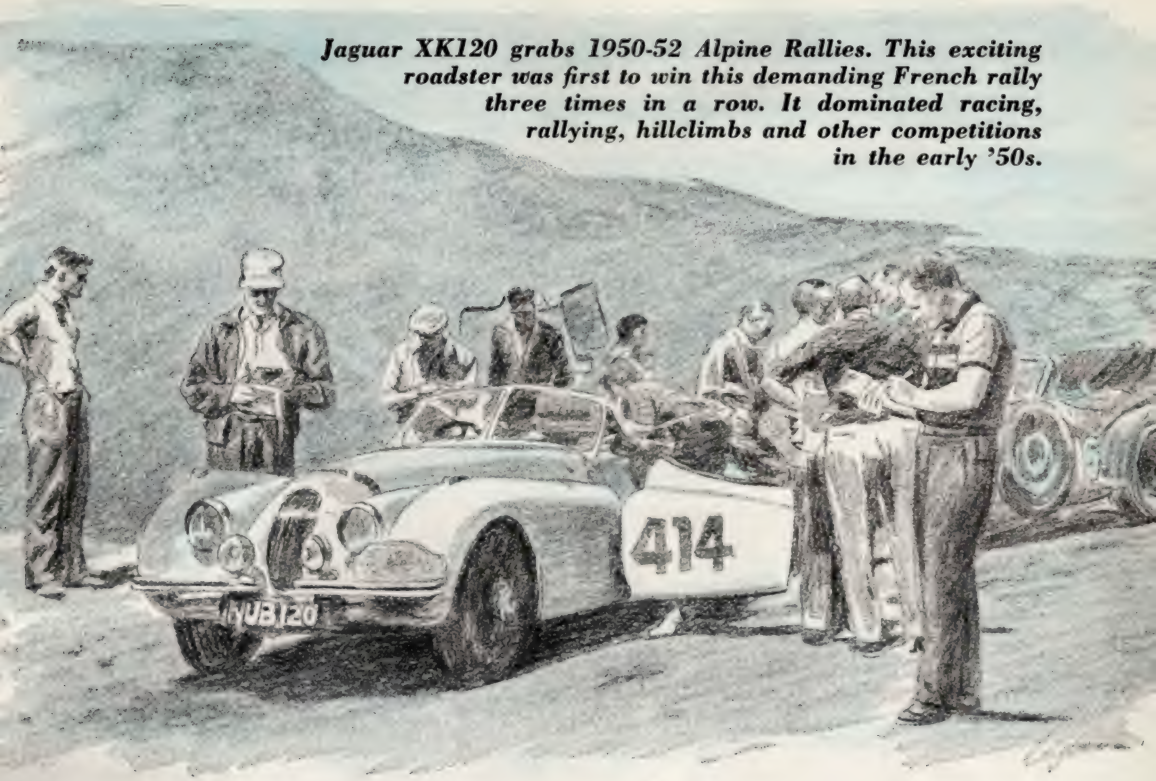
On the following pages, you'll find some of the top rally car champions in the settings that made them famous.

Pierce Great Arrow takes 1905 Glidden Tour. Both cars and roads were young then. Steamers, powerful tourers, tiny runabouts, even trucks—44 entries in all—gathered in New York for the world's first major rally, an 883-miler through New Hampshire and back. Riders in open cars endured rain, dust, police speed traps, craterlike potholes and sparse signs that pointed nowhere. But 12 days later, 26 cars had finished within the time limit. Percy P. Pierce, accompanied by parents and chauffeur, had won; his car had had no mechanical troubles.





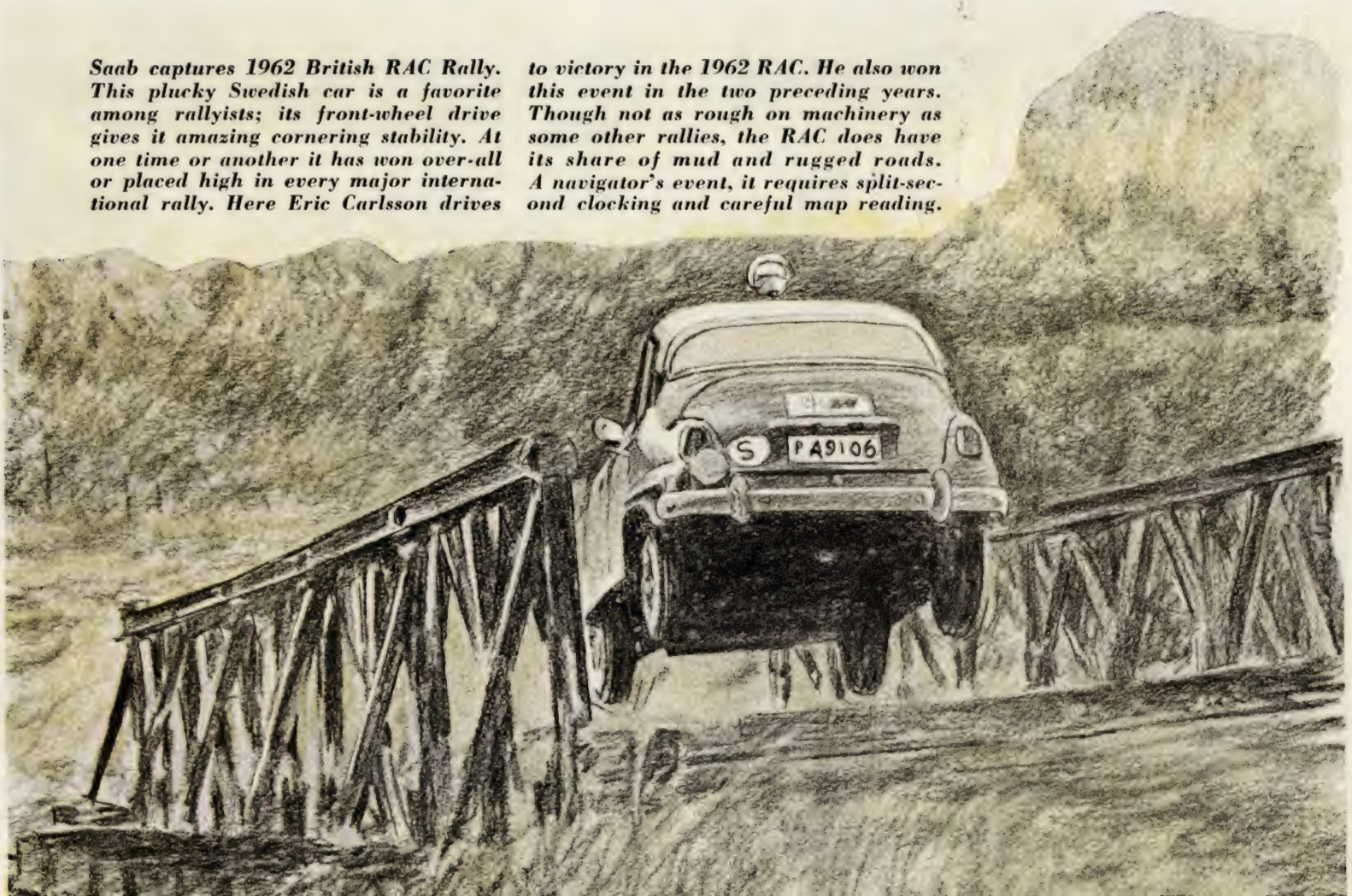
Thomas Flyer wins 1908 New York to Paris Race. Motoring across the United States, Siberia and Europe was no mean feat in 1908. Engines blew and gears stripped, forcing mechanics to travel hundreds of miles by horse-carriage and train for parts. In spite of snowdrifts, seas of mud, scarcity of gas and treachery by competitors, a 60-hp. American Thomas, stock except for extra gas tanks and raised axle, made the 21,000 miles in 170 days, beating five foreign entries.

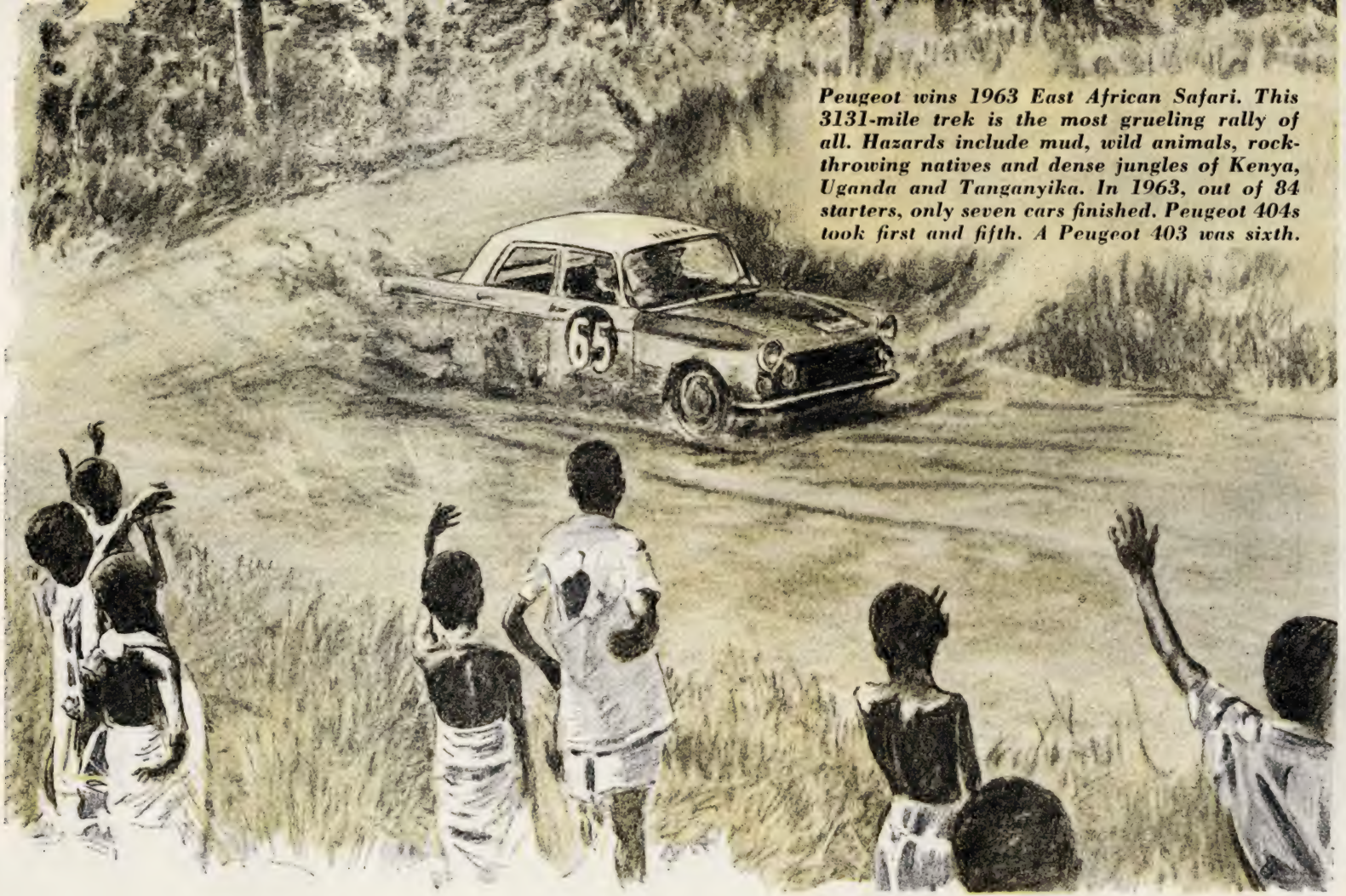


Jaguar XK120 grabs 1950-52 Alpine Rallies. This exciting roadster was first to win this demanding French rally three times in a row. It dominated racing, rallying, hillclimbs and other competitions in the early '50s.

Mercedes-Benz 300SL sweeps 1952 Carrera Panamericana. There were 1934 miles of mountain hairpins and sizzling straights, from northern Mexico to Guatemala. The three much-lightened 300SLs finished one-two-three, but the last was disqualified.

Saab captures 1962 British RAC Rally. This plucky Swedish car is a favorite among rallyists; its front-wheel drive gives it amazing cornering stability. At one time or another it has won over-all or placed high in every major international rally. Here Eric Carlsson drives to victory in the 1962 RAC. He also won this event in the two preceding years. Though not as rough on machinery as some other rallies, the RAC does have its share of mud and rugged roads. A navigator's event, it requires split-second clocking and careful map reading.





Peugeot wins 1963 East African Safari. This 3131-mile trek is the most grueling rally of all. Hazards include mud, wild animals, rock-throwing natives and dense jungles of Kenya, Uganda and Tanganyika. In 1963, out of 84 starters, only seven cars finished. Peugeot 404s took first and fifth. A Peugeot 403 was sixth.

Mini Cooper S takes 1964 Monte Carlo. A David among Goliaths, the 10-foot British Morris Mini Cooper S beat cars many times more powerful—including the runnerup, a 235-hp. Falcon V8. Most of the 299 cars started at Oslo, Norway, which was having mild weather. The Mini picked an alternative starting point, Minsk, Russia, where the temperature was −20°. Besides the mountainous rally route, the 2700-mile Monte included a road race. The 65-cu.-in., 80-hp., front-wheel-drive Mini, with top speed well under 100, relied on its fantastic handling.

Your Service Man Looks at The '65 Cars

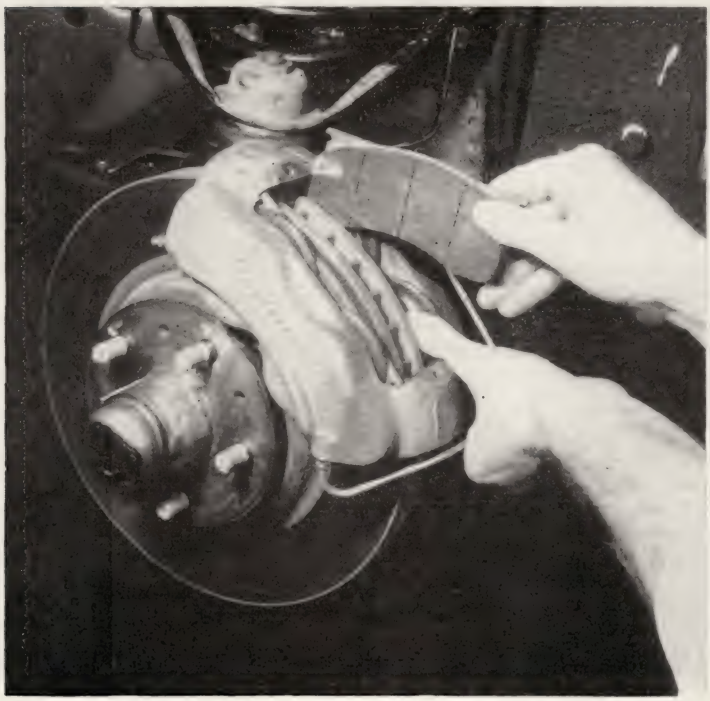
If the jiggle pins won't jiggle, tires acquire scallops and brakes squeal, here're the cures

IT'S NOT A DULL LIFE your auto mechanic leads. Each year Detroit engineers hand him enough new changes in their machinery to keep life more than a little challenging. And each year he finds that engineers have found ways to bury some of his favorite gremlins of previous years.

You can't call 1965 a rouser of a year, in terms of mechanical modifications. It's not, for instance, anything like the year air springs came to town. But your serviceman will enjoy the easier task of replacing the pads on the new disc brakes, and watching to see which disc—the retractor or the contact type—gives more servicing problems.

He'll also be watching to see whether the springier new perimeter frames produce more or fewer mysterious squeaks in the body, whether the new low-profile tires will last longer, as claimed, how well the mounting counterattack on rusty body panels proves out, and whether the jiggle-pin approach to keeping your crankcase vent valve clear works.

Most dramatic mechanical change for '65 is, of course, the



TO INSTALL new pads in a T-bird, simply slip in the shoe, holding the pistons in their bores with fingers, if necessary. Install splash shield and retaining bolts and pump the pedal for adjustment

Tips on Servicing the New Disc Brakes

Both the when and how of servicing the 1965 disc brakes is not a mysterious problem. First of all, it's easy to check pad wear. Kelsey-Hayes has a "squealer" consisting of ears on the steel backing plate that touch the disc and make a scraping sound when the lining wears under .030 inches. The scraping does more harm to your ears than to the disc, since it's not on the braking surface.

Pads can also be measured with a micrometer. Check pad and backing-plate thickness at the center and both ends. Replace any pad that's shy of .195 inches on a Continental or T-bird, or .155 inches on a Mustang.

Corvette's pads are grooved. Discard them when they're worn almost to the bottom of the groove. Rambler and Barracuda pads can be inspected through caliper openings. When pads wear to within ⅛ inch of the backing plate, change them.

Pad replacement is simpler than changing shoes in a drum brake. To remove FoMoCo pads, take off the wheel and remove the caliper splash shield. Press each pad against the caliper for about a minute —until the pistons retract into the cylinders. Weekend mechanics with tender fingers can use water-pump pliers. Use two regular pliers to grip the ears on the backing plate, then pull out pad.

To replace a pad, slip it between the disc and caliper, pushing it straight in to prevent binding. Install splash shield and retaining bolts. Pump the pedal a few times to take up clearance.

Before removing Corvette brake pads, siphon out all fluid in the master cylinder. Otherwise, the fluid will dribble out when pistons are pushed into their bores before installation of new pads.

Pads are held in place by a guide pin that passes through a hole in each backing plate. Remove the spring clip from either end of the guide pin and pull the pin clear. Then lift out the pads.

To install a new pad, push the pistons into the cylinders, then slip in the pad. A thin metal clip makes the job easier, holding pistons in place. When pads are in, replace the guide pin and retaining clip. Use fresh brake fluid.

Remove the caliper to replace Rambler pads. Take out the retaining bolts and brake-line clamp. Don't disconnect the line; support the caliper with a block of wood or wire it up out of the way.

Switch pads one at a time. Take out the worn pad, then push the two pistons into the caliper until they bottom. Don't press just one piston, or its mate will pop out. The flat edge of the pad must face the spindle. Replace all shims and install the caliper.

Pad replacement in the Barracuda Girling brakes is also easy. Remove the wheel, pull out the guide pin and lift out the worn pads. Force the pistons into the caliper and install new pads.

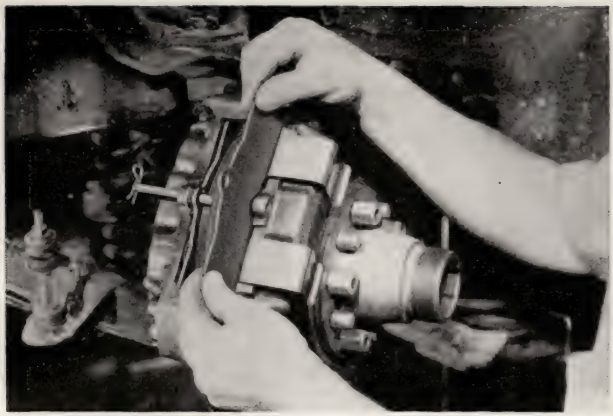
swing to disc brakes by Corvette, Continental, T-bird, Mustang, Rambler and Barracuda as standard or optional equipment. The big advantage is fade resistance. Braking surfaces are out in the open, where they're cooled by air flow. Heat is chucked away before linings sizzle and lose their grip.

How durable are these discs? Detroit cheerfully predicts pad life comparable to that of drum-brake lining, but owners' experience doesn't always agree with proving-ground tests. Early disc brakes on some foreign sports cars lasted as long as a rabbit on a fox farm. Pads wore out quickly, and road salt corroded pistons and cylinders. Newly improved sealing and better materials should help.

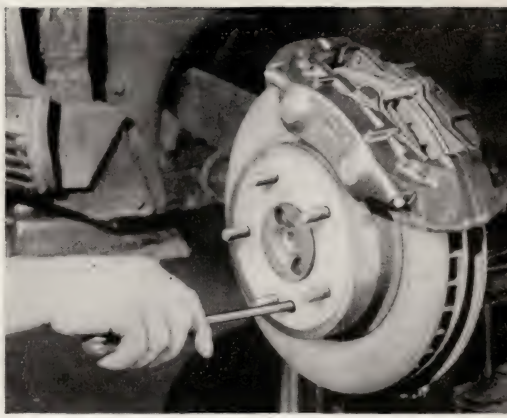
For the fat-cat U.S. cars, the disc assemblies are more massive. The disc itself is thicker, and usually has vents. The caliper, which pinches the disc like a vise to stop the car, has two pistons on each side, allowing larger pads for cooler operation and longer life.

With discs comes a confusing word game. The disc itself is also called a rotor. The pad, a segment of hard friction material bonded to a steel backing plate, is often called a shoe, and the friction material is described as lining.

All disc brakes are self-adjusting. Two basic types are used. In Corvette, piston springs hold the pads lightly against the disc at all times. As pads wear, the pistons move closer to the disc. The master cyl-

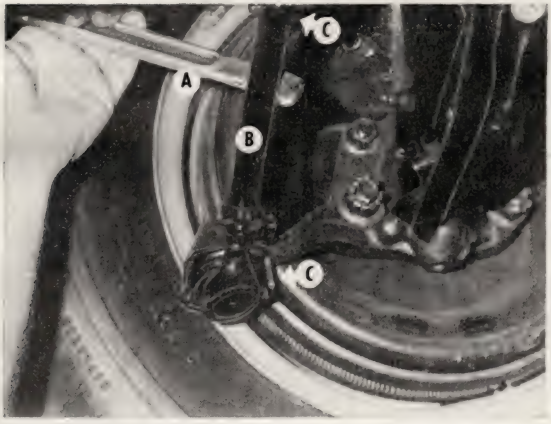


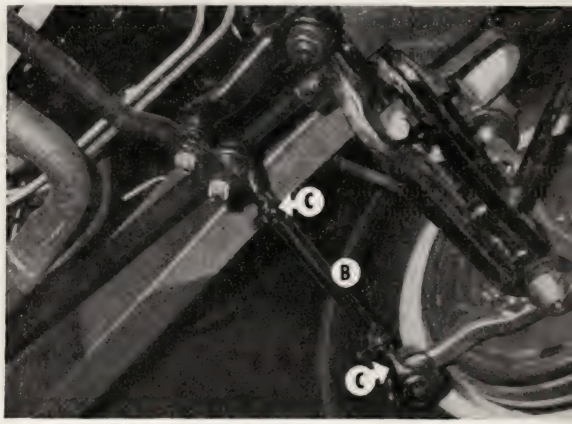
AFTER PUSHING both pistons (inboard or outboard) into housings in Corvette disc brake, prior to installing shoe, hold pistons with U-shaped clip



ACCESS HOLE allows adjusting Corvette parking brake. Pry the adjusting screw with a screwdriver till wheel won't turn. Back off 10 notches

ADJUSTING LENGTH OF TIE ROD (B) on Dodge and Plymouth is done with a special Mopar tool (A). Tie-rod end (C) must be loosened before tie rod is turned. On '65s, steering mechanism is on cross member, not frame rails





inder squirts more fluid to fill the space, and pedal travel remains constant.

On other units, pads retract mechanically when the pedal is released. Some English designs use a spring-and-pin arrangement. Ford's Kelsey-Hayes units fit a seal snugly around each piston. The outer edge of the seal seats in a groove in the cylinder bore. Brakes on, the seal stretches; brakes off, it snaps back, leaving a clearance of about .005 inches between pad and disc. When pads wear, the piston slides inside the seal to take up the slack.

Each version has pluses and minuses. With pads constantly rubbing against the disc, it would seem that Corvette's brake drag would cut performance, waste fuel and shorten brake life. 'Tain't so, says Chevrolet; contact is just heavy enough to keep water and dirt wiped off the disc and it also serves to heat the pads to their most efficient operating temperature.

Knock-Back Blues

Piston-seal retractors as on Ford's discs are subject to pad "knock-back." If the disc isn't absolutely true, its wobbling and deflection during hard cornering slaps the pads, forcing the pistons back into their bores. Then pedal travel is greater on the next application. Loose wheel bearings can also be culprits here. Ford specifies end play of .005 to .0065 inches in the bearings when the adjusting nut is tightened to 17 to 25 foot-pounds.

With four-wheel discs, as on Corvette, designing a parking brake is a problem.

POPULAR MECHANICS' 1965

MAKE	OIL CHANGE	FILTER CHANGE	FRONT SUSP. LUBE	STRG. LINK LUBE	UNIV. JOINT LUBE
American Motors					
Rambler, All Models	4000	4000	32,000-3 Yr.	32,000-3 Yr.	NR
Chrysler Corporation					
All Models	4000-3 Mo.	8000-6 Mo.	32,000	32,000	NR
Ford Motor Company					
Ford, Fairlane, Falcon, Mustang	6000-6 Mo.	6000-6 Mo.	36,000	36,000	36,000
Thunderbird	6000-6 Mo.	6000-6 Mo.	100,000-3 Yr.	100,000-3 Yr.	100,000-3 Yr.
Mercury, Comet	6000-6 Mo.	6000-6 Mo.	36,000	36,000	36,000
Lincoln Continental	6000-6 Mo.	6000-6 Mo.	36,000	36,000	36,000
General Motors Corporation					
Buick Special	6000-2 Mo.	6000-6 Mo.	6000-6 Mo.	6000-6 Mo.	NR
Buick, All Other Models	6000-2 Mo.	6000-6 Mo.	6000-6 Mo.	6000-6 Mo.	6000
Cadillac	6000-2 Mo.	6000-6 Mo.	NR	NR	NR
Chevrolet, All Models	6000-2 Mo.	6000-6 Mo.	6000-6 Mo.	6000-6 Mo.	NR
Oldsmobile F-85	6000-2 Mo.	6000-6 Mo.	12,000-6 Mo.	12,000-6 Mo.	NR
Oldsmobile, Other Models	6000-2 Mo.	6000-6 Mo.	36,000	12,000-6 Mo.	NR
Pontiac Tempest	6000-2 Mo.	6000-6 Mo.	12,000-1 Yr.	12,000-1 Yr.	NR
Pontiac, Other Models	6000-2 Mo.	6000-6 Mo.	30,000	30,000	NR
Studebaker Corporation					
All Models	6000-2 Mo.	6000-6 Mo.	6000	6000	NR

NR Lubrication not required unless unit is disassembled for repairs
■ Paper type—12,000 for plastic type
◆ V6—replace V8 filter at 24,000 miles

Corvette rear discs each have a small drum in the center flange. A flange bolted to the rear-wheel spindle mounts two cable-operated shoes. Adjust them through holes in the flange and disc by a conventional star wheel. Tighten until the brake drags, then back off to allow the wheel to turn freely.

Discs aren't the only brake news. Full-size Chrysler Corp. cars now have flanged axle shafts, making it easy to remove rear drums for brake inspection.

Ford has switched to an old-fashioned mechanical stop-light switch actuated by the brake-pedal arm. With no switch on the master cylinder, there's one less possible source of fluid leakage. Isn't progress wonderful?

The big news in automatics is Turbo Hydra-Matic, used in all full-sized GM cars except Chevrolet. It was introduced on 1964 Buicks and Cadillacs, but several refinements were added, including a variable-pitch stator previously used on Buick and Olds two-speed automatic.

At idle, stator vanes in the torque converter switch to high angle to prevent creep. Give it gas and blades switch to low angle, minimizing slippage. Open the throttle more than 40 degrees of its travel and the vanes again change to high angle for increased torque multiplication and better acceleration.

Checking Turbo Hydromatic Switch

The valve that regulates the vanes is controlled by an electric switch connected to the throttle linkage. Cadillac suggests an easy test to check electrical components. Disconnect the white wire at the side of the transmission. Connect a 12-volt test lamp between the wire and its terminal on the transmission. Place the lamp where you can see it while you drive. With ignition on, the lamp should light. At about 6 m.p.h., it should go out, then come on again when the throttle is open about 40 degrees. If the test lamp fails to co-operate, the throttle switch needs adjustment or there are gremlins in the circuit.

There are two new engines, an Olds 425-inch V8 and a Ford 240-inch Six. The Olds is similar to the 330-inch V8 in the F-85, but uses stamped, individually mounted rocker arms. The pivots are cylindrical, rather than spherical. Rocker arms and other valve-train parts can be installed

SERVICE CHECK LIST

AUTO TRANS. DRAIN	MAN. TRANS. DRAIN	WHEEL BRG. PACK	CLEAN AIR CLEANER	REPLACE AIR CLEANER	SERVICE PCV SMOG VALVE	FUEL FILTER	COOLANT
NR	NR	24,000	4000	24,000	8000	12,000	2 Yr.
NR	NR	NR	6 Mo.	2 Yr.	6 Mo.	20,000	1 Yr.
NR	NR	30,000	6000-6 Mo.	36,000 ■	12,000	36,000	36,000-2 Yr.
NR	NR	30,000	6000-6 Mo.	36,000 ■	12,000	36,000	36,000-2 Yr.
NR	NR	30,000	6000-6 Mo.	36,000 ■	12,000	36,000	36,000-2 Yr.
NR	NR	30,000	6000-6 Mo.	36,000 ■	12,000	36,000	36,000-2 Yr.
24,000	NR	NR	12,000	—	12,000	12,000 ◆	2 Yr.
24,000	NR	NR	12,000	12,000 *	12,000	24,000	2 Yr.
24,000	NR	NR	—	30,000	12,000	6 Mo.	2 Yr.
12,000	NR	NR	12,000	—	6000-2 Mo.	12,000 †	2 Yr.
24,000-2 Yr.	NR	NR	12,000-1 Yr.●	18,000	12,000	—	2 Yr.
24,000-2 Yr.	NR	NR	—	18,000	12,000	—	2 Yr.
24,000-2 Yr.	NR	NR	6000-6 Mo.	—	12,000-1 Yr.	12,000-1 Yr.	2 Yr.
24,000-2 Yr.	NR	NR	6000-6 Mo.	—	12,000-1 Yr.	12,000-1 Yr.	2 Yr.
NR	NR	24,000	6000-6 Mo.	24,000	6000	6000	6 Mo.

† Bowl type only
● V6 only
* Riviera only

without the usual adjustment for initial valve clearance. Just torque the rocker-arm retaining nut to 25 pound-feet.

With the new Hydra-Matic, the idle should be 500 r.p.m.; with stick, 550. As with other Olds engines, speed it up to 850 r.p.m. when checking timing. Also, disconnect the distributor vacuum line. Spark should occur at five degrees before top dead center. Breaker-point and sparkplug gaps are .016 and .030, respectively.

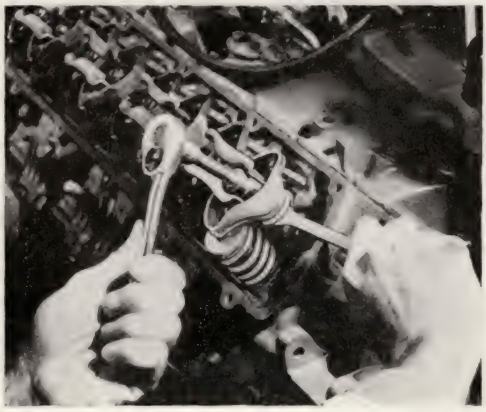
The crankshaft in the new Ford Six is supported by seven main bearings and drives the camshaft through gears. The rocker arms are individual ball-pivot types, as in the 298-inch V8.

The chubby new low-profile tire, with

(Please turn to page 226)

FUSE BOX has been moved to kickpad on some FoMoCo products, including this Falcon. It's much more accessible than in its former location under cowl

WHEN ADJUSTING VALVES on new Oldsmobile 425-cu.-in. V8, hold rocker-arm stud with wrench when removing rocker-arm nut. Retighten with torque wrench



STORYBOOK THERAPY

Kids almost hate to leave this unusual clinic, where treatment and play are the same thing

IF WALT DISNEY had been commissioned to design a therapy center for handicapped children, he might have come up with the Fairyland Clinic.

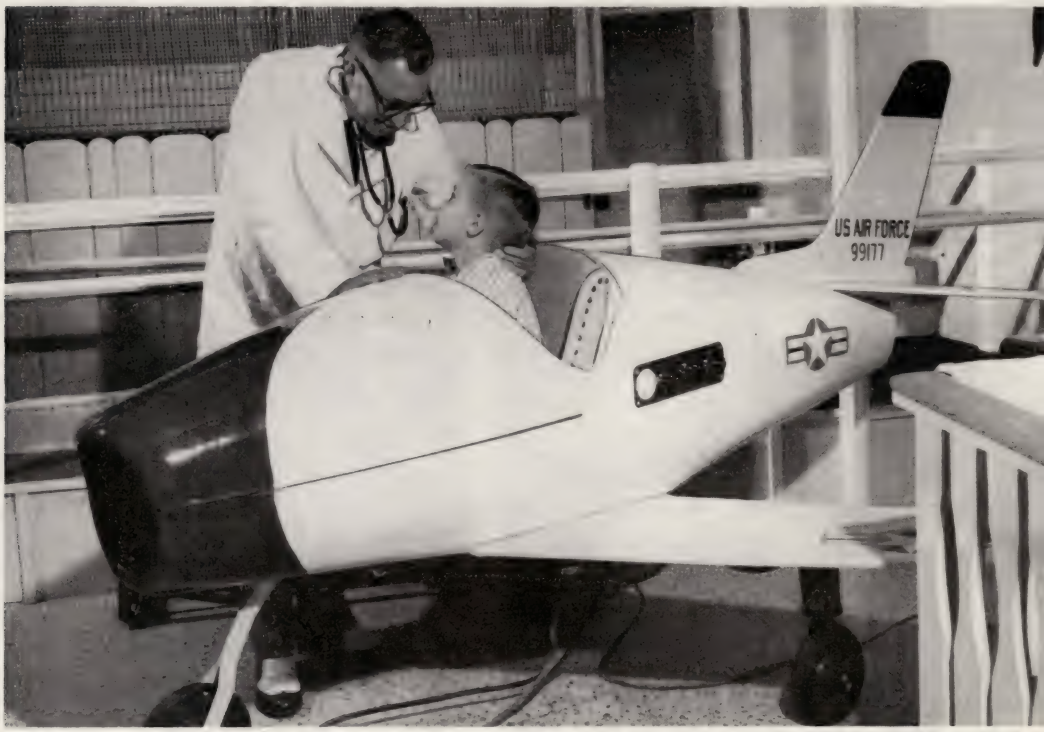
The bare white walls, frightening-looking apparatus and no-nonsense atmosphere of the usual clinic can't be found here. Children are treated in gaily decorated rooms and receive therapy while playing on specially designed toys.

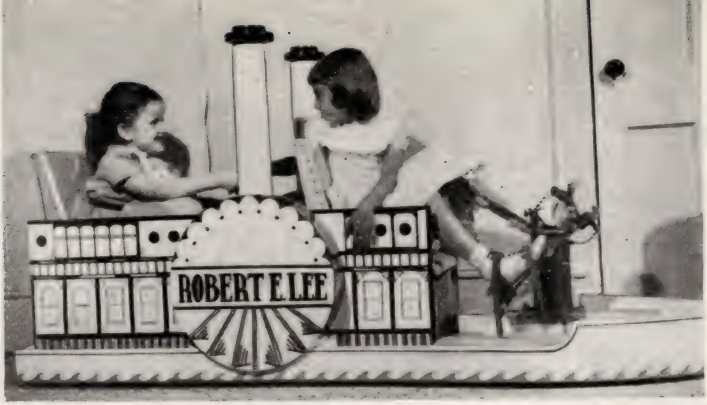
The free clinic was started some years ago by two men: Dr. Edward Connor, a pediatrician, and Owen K. Murphy, president of the Niagara Therapy Corporation. The doctor has a special insight into the problems of the handicapped because he himself has had to overcome the effects of multiple sclerosis.

He and Mr. Murphy worked together on the project. The building they selected for the clinic was painted in bright colors, with drawings and humorous cutouts used to decorate most walls. Much of the therapeutic equipment was incorporated in the play airplanes, boats and animals.

Usually about 50 boys and girls, ranging in age from 18 months to 13 years, are in treatment at the clinic in Meadville, Pa.

DR. EDWARD CONNOR heads small staff of specialists at the clinic. Shown making his daily rounds, he stops to check the muscle tone of a little boy who is being massaged by unit built into the cockpit of the toy airplane





TOYS help break the ice. New patient turns to talk with fellow passenger on steamboat while electric massage units stimulate her weakened leg and back muscles

THERAPY for disease-damaged legs is also involved here. Boxlike enclosures rest on floor and give tiny patients enough support to permit them to stand without help

A BOY RIDES on the back of a huge mechanical duck, barely aware of the pulsations created by massage units working to improve his circulation

THROUGHOUT the clinic, circus cutouts and Disney figures decorate walls and ceilings. This little girl, with assist from nurse, touches clown's hand

Poles to Catch Whales

Thousands of stakes form a weir for trapping white whales that venture up the St. Lawrence River

AFTER A LAPSE of 40 years the French Canadian fishermen of Ile-aux-Coudres, an island in the St. Lawrence River 100 miles east of Quebec City, are back in the whaling business.

Unlike other whalers, they do not employ boats or harpoons, but wait for the whales to come to them; and they catch them alive in a whale trap, a huge weir that measures three miles in length and two miles in width, and consists of 3500 slim poles stuck into the river bottom about three feet apart.

The only one of its kind in the world, the weir at Ile-aux-Coudres was being operated by Indians when the explorer Jacques Cartier arrived in 1535. Designed to catch the small white whales which were plentiful, it was the basis for a thriving industry until the market for whale oil collapsed after World War I, and the weir was abandoned. It was rebuilt four years ago when aquariums around the world offered high payment for live white whales, but neither the design nor the location has changed over the centuries.

Pursuing shoals of fish upriver on the rising tide, the whales turn with the tide, and as they move downstream they encounter the fence of poles. Frightened by the shaking of the palings, they move along the fence and into the trap, where they become stranded in the low tide.

The trappers then rush in with a stretcher on which they move the whale to a water-filled tarpaulin on a truck. As a mammal, the whale breathes air, but it must be constantly doused with water to to keep it alive during its trip to the aquarium—*Fred Bruemmer*

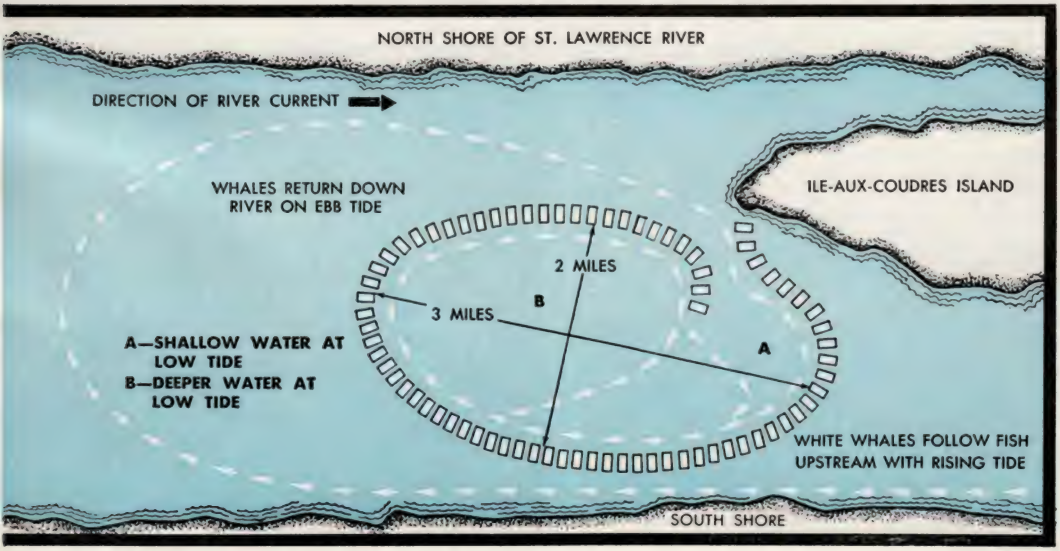
BUILDING THE FENCE for the weir, the whale trappers imbed saplings in the sandy river bottom. A strong current makes them shake, frightening a whale

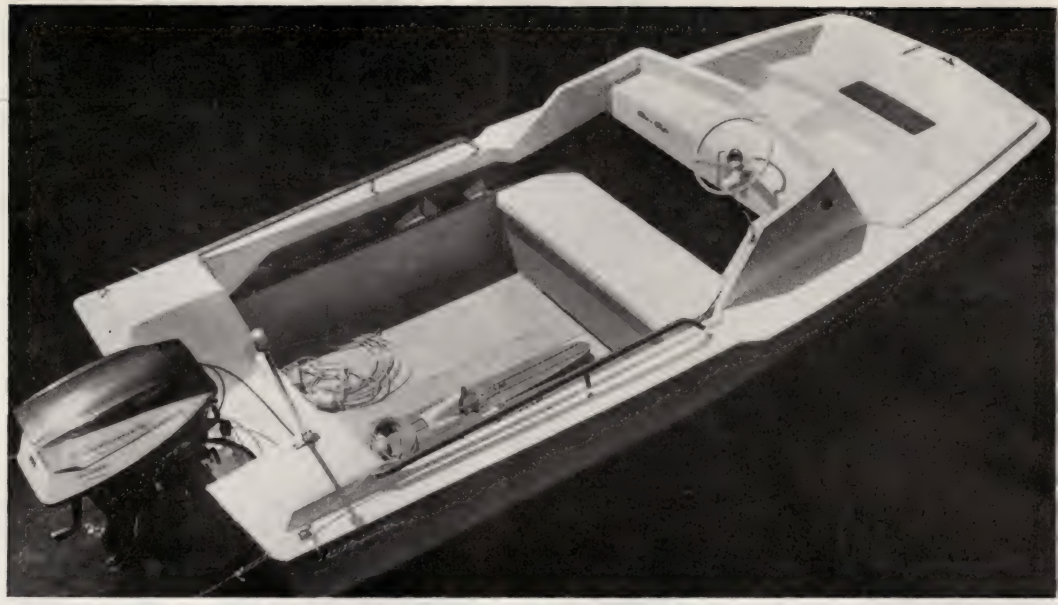
VISITORS to the aquarium in Quebec watch the white whale as it surfaces to breathe. Caught in the weir, this is the only whale in captivity in Canada

GETTING WHALE on a stretcher was mammoth job. An average white whale is the size of a large dolphin, and this female tipped scales at 1800 pounds

LIFTING THE STRETCHER from the water, the trappers transferred the whale to a water-filled tarpaulin in a truck, then transported it to city of Quebec

UNUSUAL CURRENTS make the whale weir work. The whales come upstream in pursuit of food. As they move downstream on the current they encounter the fence, and as they try to skirt it they move inside and are trapped





Casting or Sunning—Take Your Choice in Jolly Boat

Featuring only one bench seat, Chris-Craft Corsair's new 15-foot Jolly Boat is a sports design with the emphasis on uncluttered cockpit space. That shallow "sunwell" forward of the cockpit makes a fine casting platform, and will probably be more popular with fishermen than bathing beauties. Ample storage is provided under the seat and in molded side compartments.

The Jolly Boat has Corsair's sandwich-type hull—foam and balsa wood between fiberglass laminates—and sells for $1095.

Quick Draw for Clips

If your paper clip supply looks like a can of worms, you can switch to more orderly storage with a new clip dispenser made by Parker Pen Company, Janesville, Wis. Called Redi-Clip, the unit dispenses one paper clip at a time. Price is 39 cents for two.

Back-Yard "Combine"

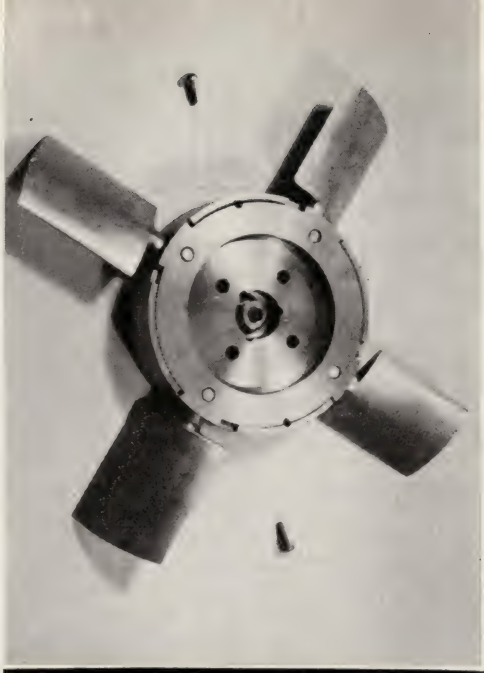
A new garden tractor attachment simultaneously mows the lawn, vacuums up as much as 26 bushels of cuttings and/or leaves, and mulches them into small flakes. It's made by Simplicity Mfg. Co., Port Washington, Wis., for its 9-hp. Landlord Tractor.

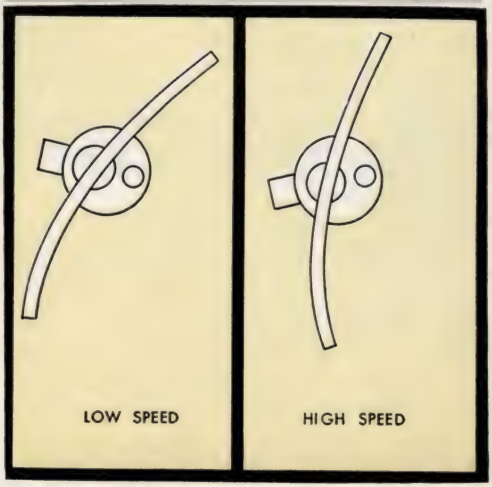
Huff-and-Puff Art

You can make straws, jewelry and free-form art objects with a new glassblowing kit. A propane torch, cutting tools, glass, blowing tube and dark glasses are included for $19.95. By Pope Scientific, 13500 W. Reichert, Menomonee Falls, Wis.

Roof Anchors

Roofs of tunnels can be made self-supporting with Roc-Loc, a paste composed of polyester resins, says the manufacturer, American Cyanamid. Roc-Loc is pumped into drill holes, where, in from 8 to 24 hours, it hardens and firmly anchors bolts.





New Angle on Fans

By automatically switching its blade angle, a new automobile fan is able to keep the engine cool during hot-weather idling while not overcooling at high speeds.

The conventional fan cools the engine even at high speeds, when it's not needed. The new Fethrinfan changes pitch at high speeds, when ram air rushing through the grille takes care of cooling.

At the fan hub a disc rotates independently over a short range limited by notched stops. At high engine speeds, spring resistance is overcome, and the disc turns, rolling the fan blades to change their angle. Made by Serck Radiator Co., Birmingham, England, Fethrinfan costs $14. It will soon be available in the U.S.

Whispering Engine

A 150-year-old invention by a Scottish minister is about to give front-line power to the Army

By Jay Arthur

A 150-YEAR-OLD heat-exchange engine, largely ignored for a century, is about to get an important role as a front-line Army power source.

With further development, the engine may also find use in outboards, refrigerators and air conditioners and irrigation pumps. It's even been considered as a power source for satellites—a project that has been explored by GM's Allison Division. But the National Aeronautics and Space Administration isn't yet sold on its long-term reliability.

The power plant was invented in 1816 by Robert Stirling, a 26-year-old Scottish minister. Now GM and Holland's Philips Co. (makers of Norelco products) have rediscovered and improved it.

For Army use, the big advantage of the engine is its noiselessness. The machinery is so simple and well balanced that there's almost no vibration. Also, no explosive combustion need take place inside the engine, so it can crank out power without sounding off to the enemy. What combustion does take place is steady, nonexplosive and *outside* the cylinder. In principle, anything from a bonfire to a nuclear reactor could supply the needed heat.

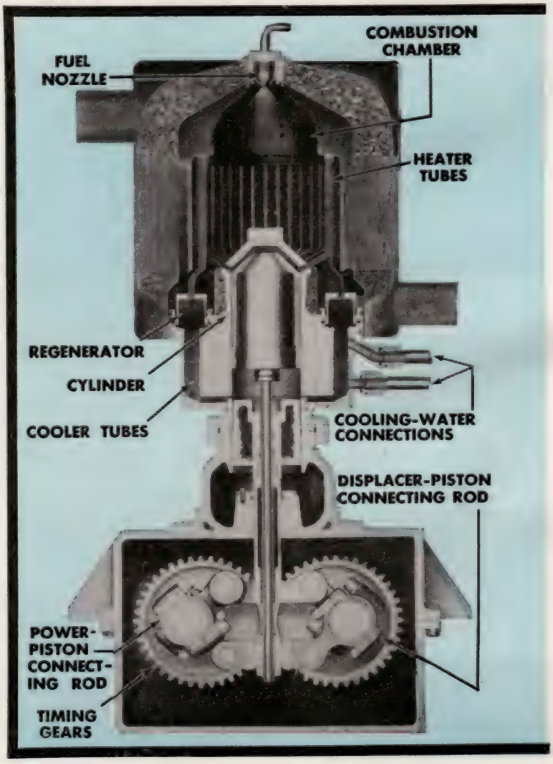
There's another advantage: With little friction and no internal combustion, hardly any cylinder lubrication is required. In fact, the lubrication system can be sealed for the life of the engine.

The Stirling is compact and up to 35-40 percent efficient—comparable to a diesel. (An internal combustion gasoline engine is only about 20-30 percent efficient, engineers maintain.)

The power plant does need a heat source, but anything that gives heat can run it—such solid fuels as coal, liquid

MILITARY VERSION of the Stirling engine satisfied the Army's initial requirements for a soft-spoken power source inaudible from as little as 100 feet

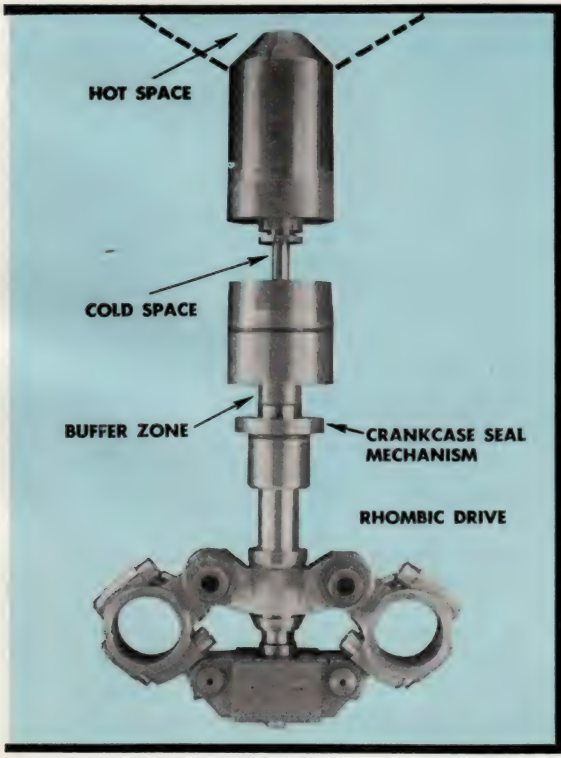
COMBUSTION CHAMBER for the Stirling is above the cylinder. With the regenerator and series of heat exchangers, the top end is kept at high temperature

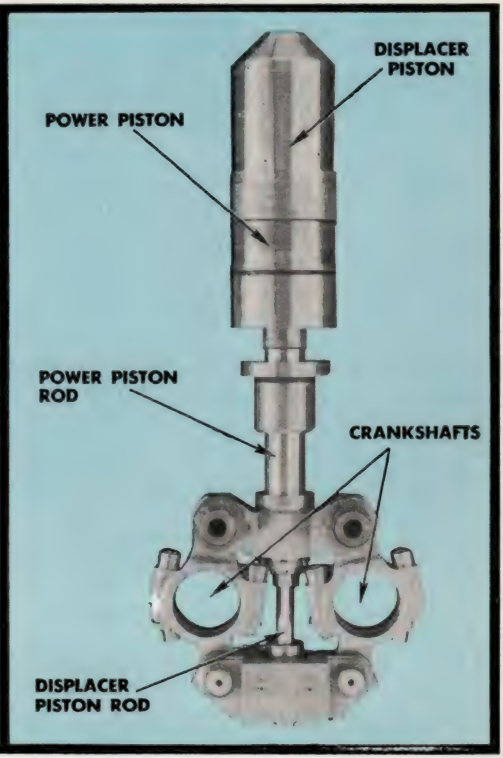


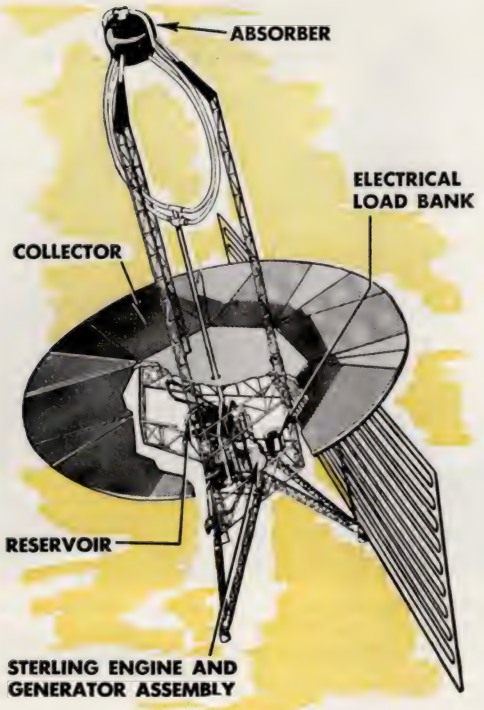
IN ZERO-GRAVITY ENVIRONMENT, such as deep space, what would happen to the Stirling's lube system? This experiment in a padded plane during an arcing maneuver proved to Allison engineers that the problem wouldn't be

DISPLACER'S MOTION shoots working gas through the regenerator (not shown) back and forth between hot and cold areas. Buffer zone also is pressurized

RINGS ARE NECESSARY on the power piston but not on loose-fitting displacer. Notice the different position of the drive as the two pistons are together







SOLAR POWER for space Stirling would be reflected to absorber, transferred to engine as liquid sodium-potassium is pumped down to the engine heater

fuels, nuclear power, even the sun.

Technically, the Stirling is known as a closed-cycle, reciprocating, thermal, *external* combustion engine. Gases that push against the piston are sealed in the cylinder and away from the combustion chamber. In its basic form, the engine has no cams or valves, no intake or exhaust ports. But strangely, it has a second piston in its one cylinder.

The lower piston, much like those in your car engine, actually kicks the crankshaft around. It has rings for a good cylinder wall seal. But it limits its up-and-down travel to the cool part of the cylinder. Above it is the second, "displacer" piston, a hollow, loose-fitting shell that moves the working gas back and forth to opposite ends of the cylinder through a series of heat exchangers without changing the volume of the closed spaces. Thus hot, compressed, energy-loaded gas is supplied to the cylinder without exploding a fuel charge inside it.

The power piston's up-stroke compresses the gas. Then the displacer goes down to move the gas through the exchanger-regenerator to the upper cylinder where it's heated. This takes place at nearly constant volume, so gas pressure rises. The energy-loaded gas spring then uncoils and drives the power piston down. The displacer sends the gas down into the cold space where it's cooled. And the cycle repeats.

The regenerator intensifies the process. As hot gas flows down, it gives up most of its heat to the regenerator, and gets it back on the way up, about tripling the basic efficiency.

Phasing of the pistons, critical to efficient operation, is by a unique rhombic drive system. Two crankshafts, parallel to each other, stick out opposite ends. A hollow rod links the power piston to the top part of the drive; through it the displacer's rod runs to the bottom of the same linkage.

More fuel fed to a Stirling doesn't mean more power. Both the heater and cooler operate at constant temperatures. Instead, you change the amount of working gas in the system, altering cylinder pressure. More pressure means more output. (A separate little pump bleeds gas to or from a storage tank. A greater load does require more fuel to keep heater temperature constant.)

A buffer zone under the power piston is sealed off and held at the mean pressure of the working gas to ease loads on the linkage and reduce leakage past the rings.

GM's Army model has a working gas reservoir and provision for bleeding gas. If it finds use in deep space, constant power would be important (and there's no room for a reservoir), so it'd be truly sealed.

How well does it actually perform? The army recently put a GM model through a 500-hour test. A 6-hp. job meant to drive a 3-kw generator, it passed with flying colors. Hydrogen was the working gas; its molecular friction is about as low as you can get so it exchanges heat with minimum loss. It ran so silently that technicians playfully set a sign before it reading, "Quiet—Engine at Work."

Fuel economy after the 500-hour test—10 percent better than the army called for—was as good as at the start, 0.6 pounds per brake horsepower hour. GM has agreed to provide two production prototypes in '65.

An experimental version of Allison's space job has already run 1000 hours at 2400 r.p.m. With its twin cranks, it drove

(Please turn to page 210)

TV Cameraman Solos

Combine a mobile TV studio, a TV tape recorder and a TV camera on a hydraulically driven 22-foot boom and you've got a $250,000 Leo. MGM Telestudio uses Leo (named after the familiar lion) for making TV commercials and programs. A power boom carries the cameraman and camera. Controlled by the cameraman, it can move up to 4½ feet per second in any direction while shooting. RCA built the system.

Quick Squirt

Attached to a helicopter, a specially rigged 45-gallon drum filled with water can be brought into position above a fire and dumped on it. Its electrically operated dump valve, controlled from the cockpit, is designed so water can be dropped in one mass or spread over 20 square feet.

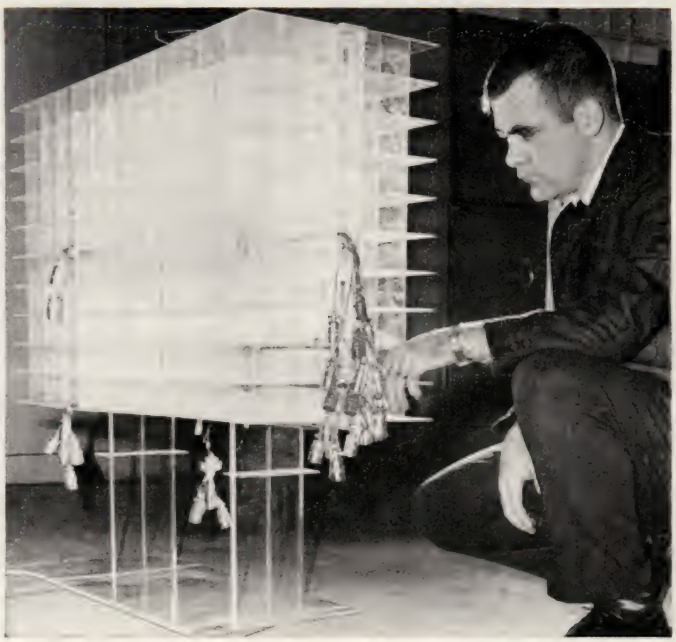
The system speeds up the work of the British Columbia Forestry Department in nipping forest fires in the early stages.

Space Test for Hotel

Methods normally used in testing the integrity of space vehicles were applied to a Lucite model (shown) of a proposed Los Angeles, Calif., hotel building.

In one test, the model was thoroughly shaken, vibrating at high speeds while sensitive instruments measured the structural effects.

The special tests were used because of the design of the planned 10-story, 410-room hotel is unusual: a concrete "egg crate" that rests on two sets of relatively slim supporting columns.



Kelly's Awful Airline

Flying the world's most hostile routes, tough polar crews boast a 5000-mile runway, spinning compasses and survival practice at 50 below

By Theodore Berland

THE SHRIEKS of the spinning, jet-powered props dropped to gentle whines, then stopped silently. The forward door of the belly-low C-130 *Hercules* opened and a smiling admiral stepped out onto a small red carpet that was spread on the blue ice for the occasion.

He was followed by his aide, by other officials, and newsmen invited for the trip. Hands snapped to salutes, then came down for shaking; flashbulbs popped and shutters clicked.

Then the party of VIPs walked off toward heavy-tired vehicles that would transport them three miles over frozen sea to McMurdo Station, headquarters base of the United States in Antarctica.

Finally, almost unnoticed, out of the ski-shod airplane came the pilot. He had just skippered the historic flight over the bottom of the world—nonstop from Cape Town, South Africa, 4600 miles across the desolate ice seas and the white continent.

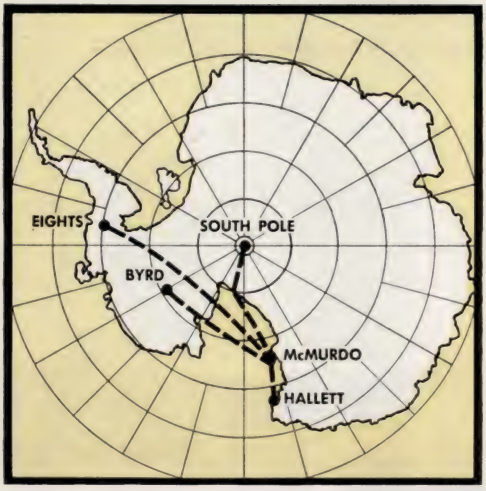
His record hop was the kind of operation that Cdr. George R. Kelly takes in stride. It was simply another flight by the world's southernmost airline.

Commander Kelly heads the U.S. Navy's Air Development

SKI-EQUIPPED C-130 is nursed into parking position by arm-waving Navy man at McMurdo Station. Skis are handy on Antarctica's "5000 miles of runways"

C-130 HERCULES, plane that put "Antarctic Airlines" in business, uses jato (jet-assisted takeoff) bottles for lifting heavy load at Byrd Station, Antarctica

STRANDED HELICOPTER awaits engine change on top of 9000-ft. Mount Discovery. Summertime temperature: 20 degrees below zero! Helicopters, single-engine *Otters* and twin-engine C-47s supplement workhorse C-130s in Antarctica



ANTARCTIC AIRLINES' regular routes include flights from base at McMurdo to Byrd, Eights, South Pole and Hallett Stations, round trips of up to 2700 miles

RADAR SCREEN shows one of major landmarks, crevasse field called The Jawbone. Radar is most reliable aid to navigation in South Pole's whiteness

Squadron Six. Called VX-6 for short, it has a monopoly. It does all the flying for Americans and New Zealanders at the world's last geographic frontier. And while it has no competition, it is efficiently run, courageously operated and highly respected—in spite of the fact that its nickname is Kelly's Awful Airline.

In many respects, VX-6 really is an airline. It has almost daily routes of delivery —1400 round-trip nautical miles from McMurdo's William Field to the South Pole Station, 1600-n.m. round trip between McMurdo and Byrd Stations, and 2700-n.m. from McMurdo to Eights Station.

That's the equivalent of flying out of Houston to Denver, to Tucson and to San Francisco. And there are other irregular, nonscheduled flights in support of the National Science Foundation's research assault at the bottom of the world.

VX-6 is a veritable supply lifeline to these isolated stations. Surface ships led by icebreakers reach McMurdo during the southern summer (December). But the men, fuel, food and equipment can only leave McMurdo via Kelly's aerial outfit.

The Navy flyboys put in grueling hours no civilian pilots' union would stand for. "The average commercial pilot logs 75 hours a month," explains Kelly. "Our pilots usually log 150 hours a month here, sometimes 200." More is demanded from the machines, as well as the men. Where a civilian *Gooney Bird* (C-47) normally flies at 26,000-pound gross weight, identical VX-6 planes gross 33,000 pounds.

In addition, flying in the Antarctic is flying in the most remote, minimally mapped, hostile land on earth. To state the obvious, it's dangerous. Of the 29 Americans who died on the continent up to 1963, 22 were killed in aircraft accidents.

VX-6 has been flying over the White Continent every season since 1955, when the Navy began its support of our scientific efforts down there. The VX-6 of today, however, is a radically changed outfit. And the degree of change is indicated in its airline-type operation.

There are two reasons for the new look. One is the accumulation of experience under unique flying conditions. The other is a unique airplane, the C-130 *Hercules*.

HEAVY CARGO is major part of operations in Antarctica. Surface vessels can bring it to shore, but only aircraft can transport it to inland bases

DISCARDED PARACHUTE serves as windbreak for mechanics. Engine prewarmer (left) pumps warm air inside so mechanics can work safely without gloves

BAREHANDED CREW does minor maintenance on C-47 engine. Without warmed-up parachute tent, hands would stick to super-cold metal parts of plane

Built by Lockheed, it is called by Kelly and the other pilots "the airplane that has revolutionized polar flying."

Four planes were put into the field during Deep Freeze '62. It wasn't long before the C-130 became legendary.

The saga of Darbyville helped make the legend. On New Year's Day, 1962, in the brightness of the southern summer evening, a lone C-130 was halfway from McMurdo to Byrd Station when one of its slim propjets began to falter, then quit. The *Hercules* simply lost a few thousand feet altitude and kept right on going.

Then the second engine sputtered and was feathered. Back in the cavernous body of the transport, Chaplain August Mendonza and some of the crew were saying silent prayers. Up on the flight deck, Marine Maj. Leslie L. Darbyshire and his copilot, Navy Lt. Donald F. Moxley, looked over the ice desert below them with more than a casual eye. They were picking the most likely looking level spots for an emergency landing.

When the third engine began to falter, they decided it was time to go in. By now they were 100 miles from Byrd. During the descent, the large rear door of the scorpion-tailed plane was opened and its 20,000-pound load of steel drums of heating oil was dumped. Darbyshire set up a landing pattern and brought the big aluminum bird smoothly onto the ice.

Bringing the plane down was just one

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ANOTHER CHORE is supplying field sites of scientific expeditions such as those sponsored by National Science Foundation, on the ice cap. This site, located in Pensacola Mountains area, conducts research in polar cold

Bananas Launch Fish

FACED WITH THE TASK of launching a 157-ton underwater observatory into a natural aquarium, the managers of Homosassa Springs, an aquatic showcase on Florida's gulf coast, covered the ways with a lubricant that was both slippery enough and harmless to fish—ripe bananas.

Like the underside of an iceberg, the windowed observatory hangs beneath a roomy sundeck. Twelve thousand dollars worth of two-inch glass gives observers a panoramic view of the 55-foot deep natu-

GREASING THE WAYS for the launching of the underwater observatory called for lubricant harmless to the wide variety of tropical fish. It was edible, too

TAKING A TIP from old Max Sennett film comedies, owners of Homosassa observatory covered launching skids with a safe and slippery lubricant—bananas

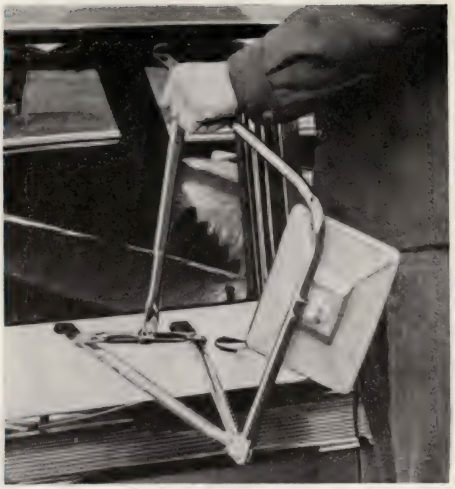
LIKE AN ICEBERG, most of the floating observatory is underwater. (Dotted lines show the underwater portion.) The windows in the 157-ton craft are two-inch-thick glass, and they give tourists clear view of aquatic life in the Spring

Observatory

ral spring, which is noted for its teeming population of various fresh and salt water fish. The observatory was custom designed for the Norris Development Co., owners of Homosassa Springs, to highlight this unique mixture of fish species.

BALANCED BY A CRANE, the observatory slides down the banana-greased ways and into the water. The slanted windows give the best possible viewing angle

SOMETHING FISHY about this scene, and it seems as though the inhabitants of the Spring are as curious as the photographer who is taking their picture



Big-Picture Mirrors

A panoramic trucker's view helps you back a boat, pickup, or trailer. The mirrors, each 5½ by 7½ inches, keep you posted on what's happening back there. They snap into the window opening in any vehicle with door frames surrounding the glass. The distributor, O.K. Eastman Co., Box 462, West Covina, Calif., sells them for $21.95 per pair, plus 75 cents postage.

Long Lawn Cleaner

An electric lawn and back-yard vacuum comes with an optional 10-foot hose extension that reaches under bushes and stairways, into window wells and around trees. The speed-Vac, made by Speedway Manufacturing Co., La Grange Park, Ill. (a division of Thor), sells for $129.95. The plastic hose costs $29.95 with 34-inch aluminum nozzle.

ICE FISHING SHANTIES come in every conceivable size and shape. These four-man units, made of paperboard, were modeled after U.S. Army arctic shelters

Frostbite

EELING requires a long pole with a head of multiple barbs that is pushed into deep bottom mud where the eels hole up for the winter

SPEARING NORTHERN PIKE is done from a completely darkened shanty, allowing the spearer a clear view of the water and any passing fish beneath the ice

ICE CHISEL leans against a canvas shelter next to bait bucket and a scoop for keeping hole cleared, as one man fishes and another prepares a hot lunch

Angling's New Gadgets

Sane men are deserting hearth and home for frozen lakes, biting winds and sub-zero weather. It's the ice fishing mania—and it's real cool

By Stuart James, PM Outdoors Editor

ICE FISHERMEN and the snobbish aficionados of the dry fly have something in common—both breeds seem plagued by a seasonal madness that warps the reason of otherwise sensible men.

The dry-fly specialist must be considered more of an artist, but it is the ice fisherman—sitting out on a windswept lake jigging a pint-sized rod up and down while the temperature stands at 30 below zero—who gets my vote for fortitude.

There is an old yarn that circulates in the Midwest about an ice fisherman on a river who tangled with a big fish and was pulled through the ice. The next day his body was pulled from the water many miles downstream. The authorities sent a telegram to his wife, in which they added that when he was fished from the river his boots and clothing were full of fish. The wife, who was also an ice fisherman, fired back an immediate reply: "Set 'im agin. I'll be there in the morning!"

In the past 10 years there has been a boom in ice fishing. This year Minnesota and northern Wisconsin expect to have more than a million anglers on the ice, and almost every lake in the country where the ice is thick enough will look as though a shanty town had blossomed overnight.

Modern technology has been a boon to the sport. When the insulated rubber boot was developed for troops during the Korean War, it was just a matter of time before ice fishermen were swarming into surplus stores to buy them up. And a lot of people who had cold feet about the sport, could now take the sub-zero weather in comparative comfort. Aside from boots there are new insulated clothing, portable shelters and a variety of augers for drilling easily through the ice.

LIGHTWEIGHT POWER AUGER weighs only 16 pounds and goes through ice like butter. This unit is made by Polaris Power Pole, Inc. of West Hanover, Mass.

SELF-PROPELLED fishing shanty built by Richard Swanson of Minneapolis is powered by a six-hp. engine and runs on plywood tracks on two flotation tanks

Although it seems to be a simple sport in which the fisherman merely hovers over a hole in the ice and dangles a line, there are many techniques and refinements that become apparent when you talk with the experts, and the type of equipment used on the ice is totally alien to the fair-weather fisherman.

The ice in the north country will be as much as three feet thick. To get through this, the ice fisherman uses a spud or an auger. A spud is a chisel about five feet long. The cutting section is a piece of spring steel about eight inches long, chisel-shaped at the end and welded to a twelve-inch piece of one and one-half inch pipe that is filled with lead and fitted to an axe handle.

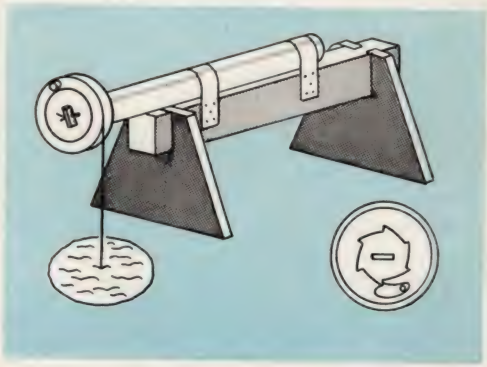
Ronnie McKee, a veteran ice fisherman of Winona, Wis., was showing me his ice spud, and pointed to the leather thong at the end of the handle. "This is important," he said. "You feel pretty foolish when you chop through the ice, and you're not hanging onto that thong and down she goes."

Most ice spuds are fashioned by a local blacksmith or welder, but they can also be purchased commercially. The Arnold Tackle Co. of Paw Paw, Mich., sells one for $7.50 that is all steel and comes in three jointed sections. They are sold in

MODERN ICE ANGLERS are adopting the motorized skimobiles. These units are expensive, but they will travel through any terrain and the deepest snow

HOMEMADE SLED is designed to carry fisherman's gear and also a Seater-Heater, a low-power stove upon which the fisherman can sit and keep warm

UNIQUE TIPUP employs a battery-operated signal light that is automatically flipped erect and lighted when a fish hits the line and triggers mechanism



ATTACHING one ratchet from the spring section of a shade roller to a slim ice fishing reel creates a device that will automatically reel in a pan fish

most sporting goods stores in ice fishing areas.

The augers are designed to bore through the ice, and they are imported from Scandinavia. The Finnish auger looks like a large steel cork screw, and it is used like one. They sell for about $18.95. The Swedish auger looks like a slightly lopsided scoop with a razor-sharp leading edge, that is attached to a brace. The Snabb, which is imported by Strike Mas-

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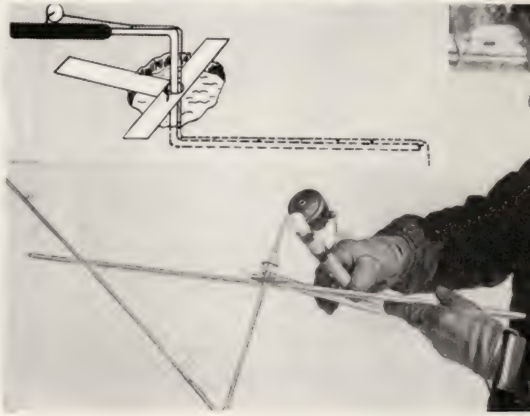
SWEDISH AUGER resembles a razor-edged scoop that is turned by a brace. A skilled operator can cut through three feet of ice in less than a minute

TO GET AT THE FISH that shy away from the hole in the ice, Fred DeBell of Denver, Colo., designed a rod with a twist that will give him greater range



Lightweight Snowthrower

Though weighing only 20 pounds, a new snowthrower is said to be capable of throwing one ton of snow a minute. It's powered by a three-hp., two-cycle engine.

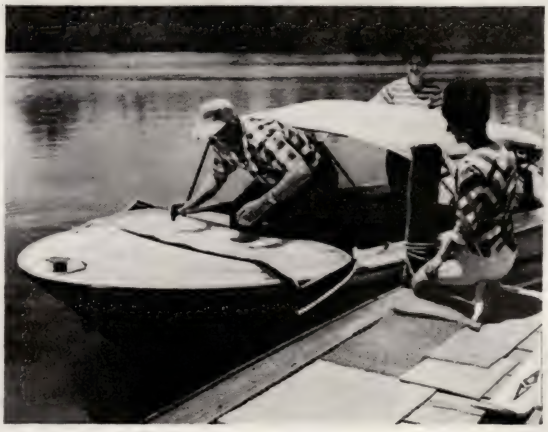
Instead of the customary rotor and chute, Toro Snow Pup uses a combination of polyethylene paddles (arrow, far right) and directional fins to throw the snow. Handle (center photo) controls fin angle.

The machine cuts a 14-inch swath, is easy to maneuver and has two handles; the lower one enables the operator to pick up the Pup and cut into a drift from the top. It's priced at $89.95.

Runabout Strips for Sport

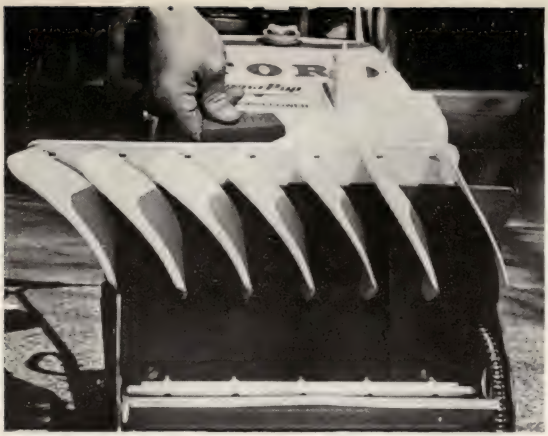
Offering unusual opportunities for cockpit customizing, Duracraft's aluminum Sportsman can be converted from a tight little runabout to a wide-open sports layout by just zipping out the flexible windshield, peeling off the deck cover and folding the top back behind the rear seats.

In addition, quick-change seating lets you rearrange the four upholstered seats without tools to provide up to 14 different seating arrangements. The 16-foot model sells for $980 and the 18-foot version for $1295, with top, windshield and deck cover available at extra cost.



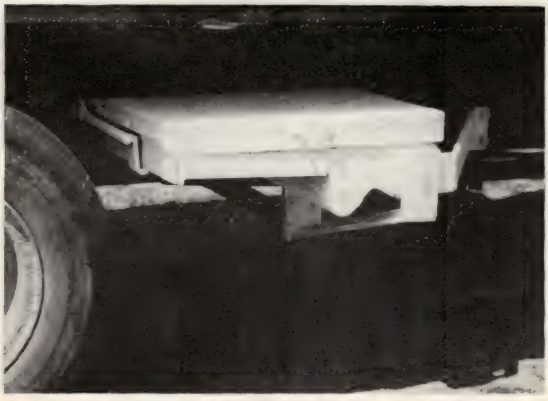
Navy Launches a Side-by-Side Underwater Craft

Underwater exploration has another new tool in the Navy's new Minisub, a 14-foot, 85-inch wide craft which accommodates two men lying side by side, their arms free to operate cameras or other instruments. Minisub is equipped with aircraft-type propellers capable of about five m.p.h. which are driven either by foot pedals or by a one-hp. battery motor. The guppy-shaped craft is shark-proof.



Emergency Brake Brings Runaway Trucks to Quick Halt

When normal braking fails in a heavy transport truck, the driver can employ a new emergency system which stops a 12-ton truck travelling at 35 m.p.h. in 40 feet. Designed by Mr. W. M. Shand of Strathalbyn, South Australia, the system consists of two tough rubber pads vulcanized to steel plates, about two feet square, which are dropped beneath the rear wheels when the driver actuates an emergency lever.



They Ride the Mighty Mites

PUT A MEDIUM-SIZE MAN in the saddle of a midget-size motorcycle, and you have the ingredients of a whale of a time. This, at least, is the contention of 30 ingenious Californians who have formed a club for the enjoyment of bite-size bikes.

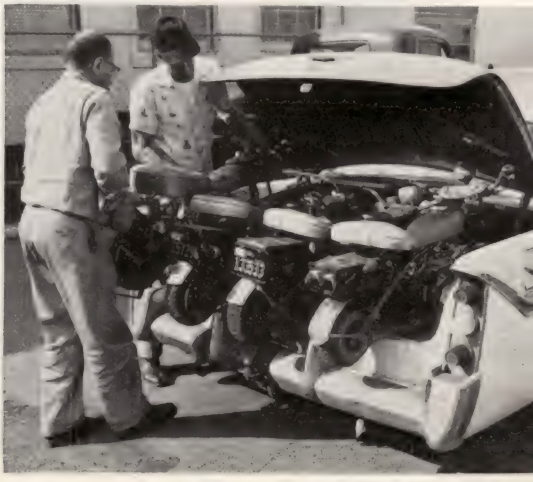
Less than 19 inches high and only 32 inches long, each vehicle, except for engine and accessories, is built by the Lincoln Village Midget Motor Corps, whose members include a variety of tradesmen.

The power from a Clinton motor, yielding 2½ hp. at 3400 r.p.m., is applied to the rear wheel through a centrifugal clutch and two size-35 roller link chains. One chain links the motor to a sprocket in front of the rear wheel. A shaft transfers power to the other side where a second chain applies it to the wheel. It uses go-kart wheels, half-inch gas pipe for frames, and is braked by a disc on the shaft.

Thirty m.p.h. is easy for these Lilliputian cycles. With a McCulloch Mac 20 saw engine 50 is possible.—*John Boykin*

THREE-WHEELED version of the midget motorcycle is designed to carry the flags when the Lincoln Village Motor Corps performs in its parade formation

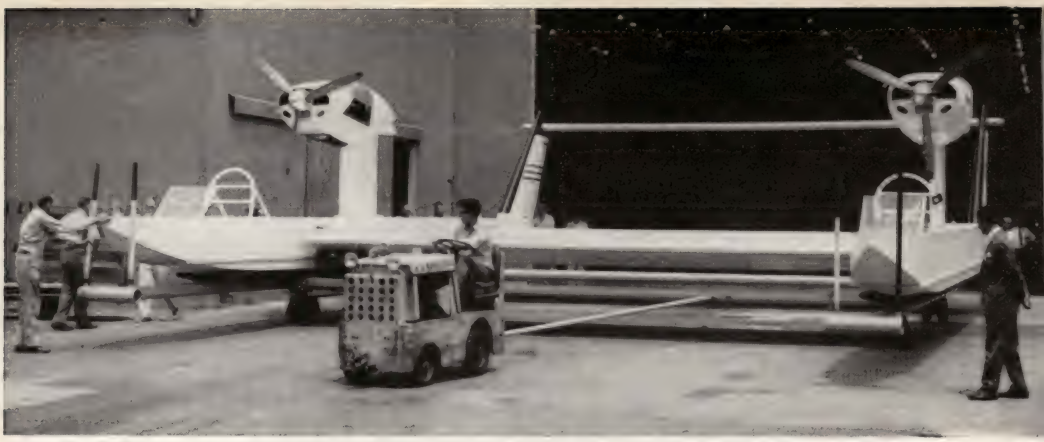
TRANSPORTING the Lilliputian vehicles is no problem for the club when four of the tiny bikes will fit into the rear trunk of an average-size automobile



WHEN NOT PARADING or racing, members of the motor corps gather for a session of drill maneuvers, wheeling through complex patterns that will evoke cheers and applause when they are finally executed during a public display

RACING THE MIDGETS is a popular sport. A member of the club uses his feet for balance as he comes into a turn with the others coming up close behind him

COMPLETELY AIRBORNE, one of the little bikes carries a full-size man on a ramp leap, showing that the tiny terrors can do anything a big cycle can



NEW CONCEPT in ground-effect machines—consisting essentially of two airfoils suspended between two catamaran hulls with an added "flying tail"—is rolled from hangar before its first and only test flight early last year

Flying Catamaran: A

Two "cat" hulls hanging under a pair of tandem wings promise 100-m.p.h. luxury sea transport

By Tom Stimson

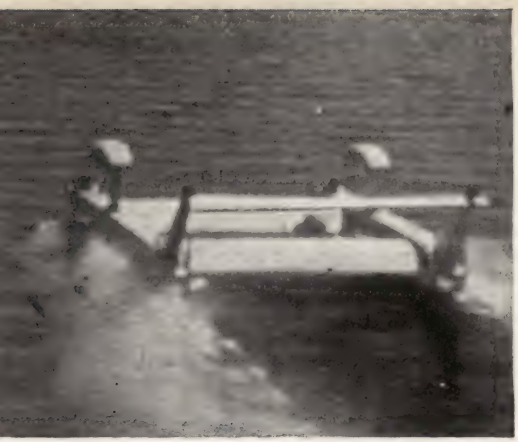
A CUT-RATE PRICE for trans-Atlantic crossings ($150 round trip) is one of the exciting promises held forth for a new, large kind of air vehicle that is being studied by the aviation industry.

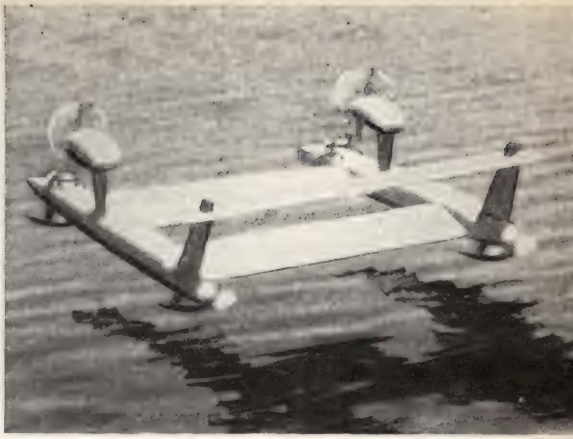
One of the big transports, literally a "flying catamaran," would carry as many as 3000 passengers and cruise between New York City and London in less than 30 hours. It would fly just above the wave crests to take advantage of ground effect.

The date? It all depends. First the aerodynamicists must solve one problem.

The ground effect, or surface-effect phenomenon that the new vehicles would use, has baffled, and annoyed, aircraft designers for decades. They know they can achieve vast economies by flying close to the surface, yet they encounter some

FLYING CATAMARAN, in artist's conception, might ultimately gross 1000 tons and carry 3000 passengers on trans-Atlantic hops, riding just above the wave tops on cushions of air created by its two tandem airfoil sections





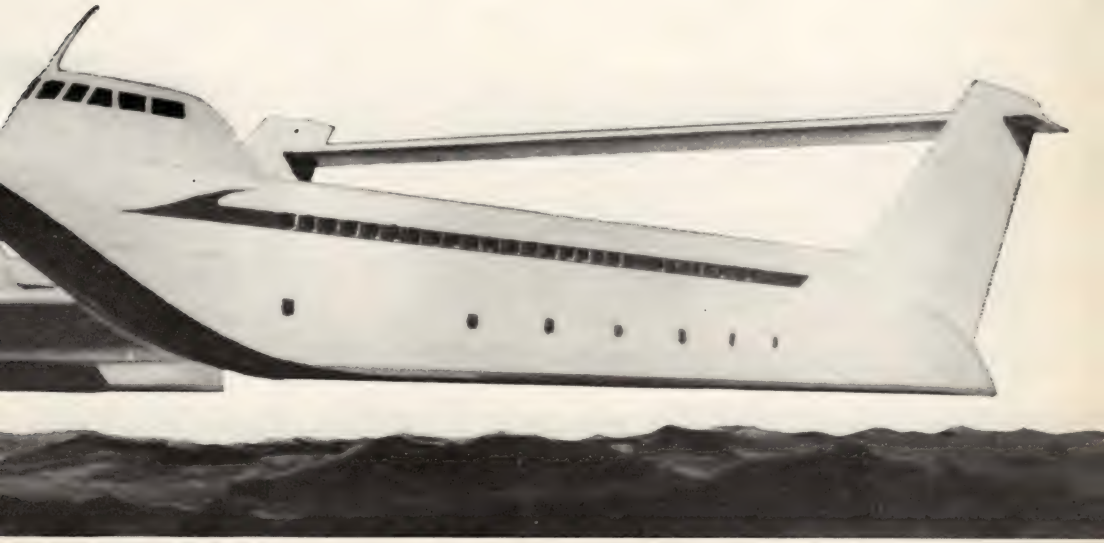
NEW MACHINE takes off, skimming the surface (left) on its hydroskis at about 70 knots, then lifting off to an altitude of eight feet. Craft subsequently tilted upward, rose to 25 feet, stalled, mushed in and crashed

GEM with Promise?

strange troubles when they try to do so. The ground-effect layer is the one region between zero altitude and outer space that hasn't been conquered.

Aerodynamicists explain that an airfoil in free air has a lift-to-drag ratio of about 18 to 1. That is, the shape can lift 18 pounds for every pound of drag that it acquires by friction with the air. But when an airfoil is flown very close to the surface it gets some support from the cushion or wedge of air that builds up between it and the ground. Lift increases and the drag goes down. The wing can now lift 35 to 50 or more pounds for every pound of drag.

No wonder aerodynamicists are fascinated! The potential payload goes away up, with no need for additional power. National Aeronautics and Space Administration (NASA) research shows that, to make use of surface effect, a wing should be flown at height of less than one third of its chord. This means that if a wing measures 20 feet from leading edge to trailing edge, it should remain below seven feet from the surface. The need to stay close to



the surface for efficient operation, and yet maintain ample clearance to avoid wave impacts, leads to the concept of very large vehicles for over-water use.

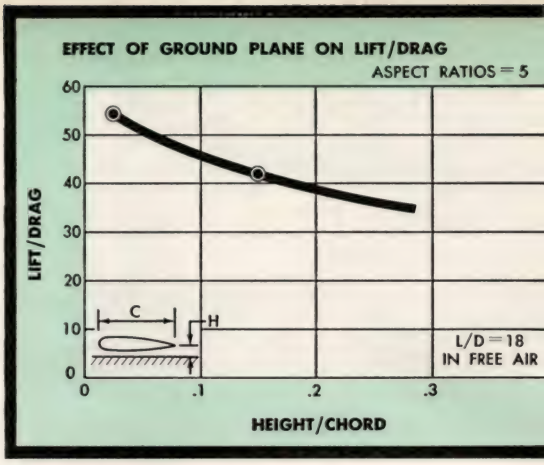
The big trouble is that an airfoil becomes unstable when flying on the ground cushion. The trailing portion of the wing gets a lot of lift from the air that has been compressed below it. The center of lift shifts aft and the nose starts to dive. Then, unpredictably, the center of lift may shift forward, possibly a little, possibly a great deal. The nose tries to climb.

This continual lack of stability calls for constant, instantaneous, automatic correction, or for some entirely new method of maintaining stability.

Rewards will be great for the person who finds the right solution, if it hasn't already been found. An enormous demand exists right now for a class of ocean vehicle in the speed spectrum between surface ships and fast aircraft. A big flying catamaran that travels at 100 knots would be about five times faster than most passenger liners, and could carry five times the cargo of a large airplane. Operating costs per ton mile, it appears, would be about midway between the ship and the aircraft.

One of these big flying cats could overfly 20-foot waves. It could detect by radar the few intense storms that produce taller waves, and run away from them or skirt them. It would be immune from detection or attack by submarines lying deep below.

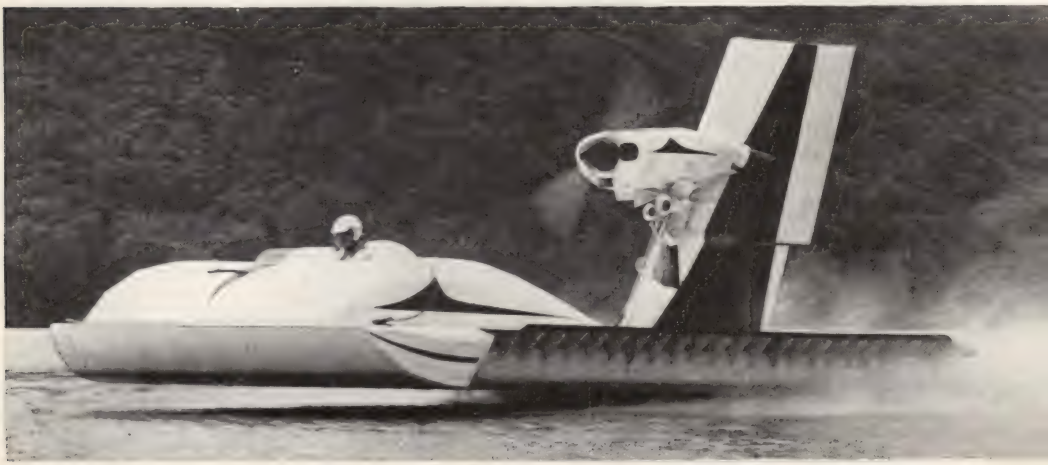
The Maritime Commission has studied the concept and looks on it with a great deal of interest. The Navy, obviously, is intensely interested.

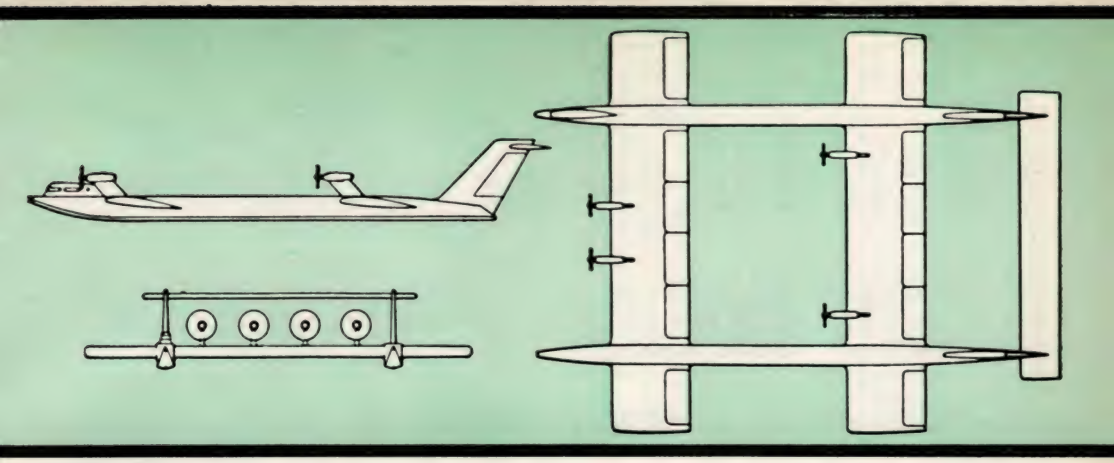


LIFT-TO-DRAG relationships are shown on chart. When airfoil is operated within ground-effect distances, its lift ratio can be doubled or tripled

There's a possibility that the surface-effect phenomenon has been tamed by a Swiss engineer, Carl H. Weiland, who is one of the pioneers in ground-effect machines, or GEMS, as they're nicknamed. Weiland built his first air-bubble GEM about six years ago. This type of vehicle rests on the air bubble, or cushion, that it creates by blowing a large volume of air downward through openings in the hull. Four years ago Weiland designed the very successful GEM *Everglade* flying river boat for Reynolds Aluminum Co. This 31-foot craft, spectacular in appearance, uses

EARLY GEM, the *Everglade*, was created by Weiland and is now in use at Louisville, Ky., as a flying river boat. It uses the standard ground-effect principle, riding on cushion of air created by blowers installed in the hull





THREE-WAY DRAWING of side, front and top of new Weilandcraft shows principal parts, two airfoils, two hulls, flying tail and as many engines as are necessary to produce power. Largest may have as many as eight engines

a 150-hp. engine for maintaining an air cushion under the hull, and a separate 180-hp. engine for driving an air propeller. The craft skims the water at 95 m.p.h.

But conventional GEMs have limitations. Their ground clearance is marginal. Payload capability is poor.

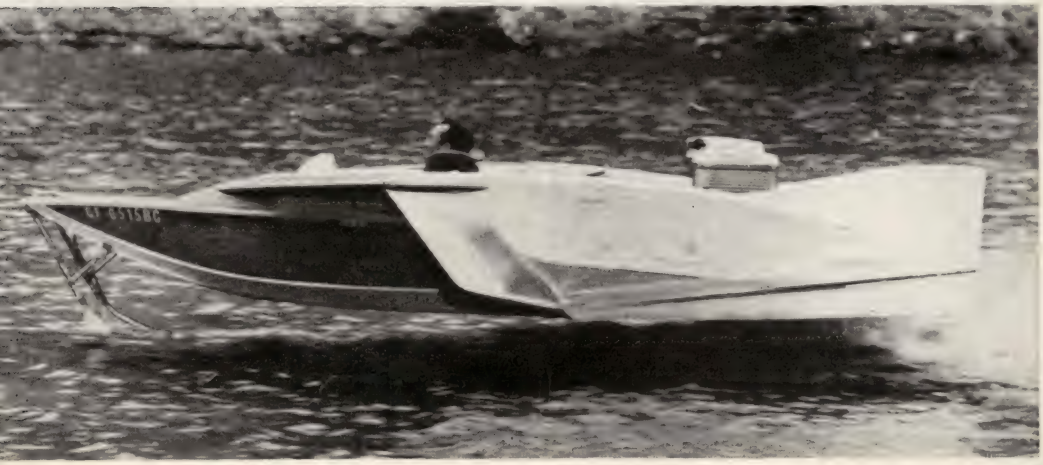
Weiland's next step was to investigate the "dynamic" concept by which a craft creates its air cushion through its own forward motion, close to the ground. His solution to the control problem was both direct and simple—use two wings in tandem, one behind the other. In effect each wing counterbalances the other.

The theory is that if the vehicle begins a fore-and-aft pitch, one wing approaches the surface and acquires more lift, while the receding wing loses its lift. Automatically, the vehicle tends to return to a horizontal attitude. Heave, and roll, similarly cancel out.

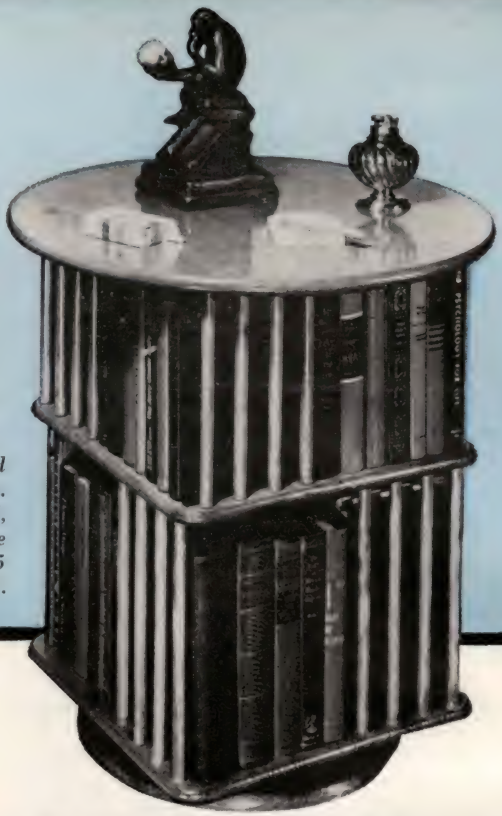
A big Weilandcraft of 1000 tons gross weight would consist of two catamaran-like hulls joined by tandem wings and a high horizontal tailplane. The vehicle would be 500 feet wide, as long as 700 feet. Each hull would be 20 feet wide, 25 feet tall, and the thick wings would contain cargo spaces measuring 10 feet from floor to ceiling. Studies show that a large ve-

(Please turn to page 206)

FLYING MOTORBOAT, created by Lockheed Aircraft Corp., is essentially a watercraft. The wing section takes advantage of ground-effect cushion, but hydrofoils and propeller remain in water—another approach to airfoil GEM



New for Your Home



***BOOK END TABLE** revolves on concealed ballbearing swivel, holds about 60 volumes. Close to 26 inches high and 24 inches around, the lazy-susan table kit in pine or maple finish assembles in one hour. Price: $19.95 from Yield House, North Conway, N.H.*

***DESK LIGHTER** runs on 22.5-volt battery which ignites air-gas mixtures when you press button; flame goes out when you put lighter on table. A cartridge of gas for year-long operation is housed in chrome and leather case. $29.95; Sunbeam Corp., Chicago, Ill.*

***TRAVEL KIT** is an electric toothbrush, vibrator and shaver all in one. A single flashlight battery operates the easily changed attachments for use anywhere. Ten-dollar German-made unit includes cleaning brush, sanitary cover, battery and case. United Trading, 110 W. 34th St., N.Y., N.Y.*

REVERSIBLE DOOR *changes from screen to storm in 3 minutes via an interlock action between curved edges along entire height of door and its frame. Of aluminum, $29.95 pre-hung door is made by Feather-lite Mfg. Co., Div. of General Capsule, 21000 Hubbell, Detroit, Mich.*

PLANT WATERER *regulates itself, will water your plant up to 3 weeks. A hygroscopic closure adjusts the flow of water to the humidity in air; tinted globe traps chlorine gas away from plant. Units are two dollars each. Rudson-Wood, 15 W. 44th St., N.Y., N.Y.*

CABINET SHIELDS *of clear plastic cling to wood or metal, fit all handles (round or oblong). Shields can be painted or backed with colored paper to cover damaged areas of walls, tables, etc. Set of 2 costs 29 cents. By Hauke's Mfg. Co., 4050 N. 24th St., Milwaukee, Wis.*

HAIR CLIPPER *fits your vacuum cleaner hose attachment, is completely air powered. Air flow directed over clipping blades keeps head cool; hair is vacuumed as it's cut. Plastic unit with steel blades is $19.95. By Vacu-Clip Corp., 5381 Otto Ave., Rosemont, Ill.*

Falcons

With gulls creating a hazard for aircraft, the Canadian government called upon an ancient missile—the deadly peregrine falcon

By Jim Ryan

FLOCKS OF BIRDS have long been a hazard for flying aircraft, but in British Columbia the danger was magnified when large groups of gulls took up residence on airfields.

In the past three years in Canada there have been 400 collisions between birds—mostly gulls—and civilian and military aircraft. The damage has exceeded $2 million, including the scrapping of a jet engine that was damaged beyond repair.

The Canadian National Research Council at Ottawa was called upon to find a

READY FOR ACTION, the trained falcon perches on the gloved hand of trainer Frank Beebe prior to being launched for an attack on a flock of sea gulls

SWOOPING DOWN from above, the falcon attacks a gull, one of thousands that have caused $2 million in damage to Canadian aircraft in past three years

Clear the Airways

solution, and they have reached back into medieval history for an anti-gull missile —the trained falcon.

Frank Beebe of Victoria, B.C., a 49-year-old employee of Canada's provincial museum and a falconer, was assigned the task of clearing the airways of sea gulls.

In the spring of 1963 four peregrine falcons, the second largest of their type in North America, were taken from their nests in the Queen Charlotte Islands off the coast of British Columbia. Beebe began training them, and in September of that year he took a leave of absence from his job to devote full time to the project.

The idea was not to kill great numbers of gulls, but to create a menace that would keep them away from airfields.

A major problem in the training was the natural inclination for falcons to ignore sea gulls, but Beebe trained his four birds with gull-shaped lures only, rewarding them when they attacked.

The first field test was held at Patricia Bay International Airport before observers from the R.C.A.F., the Wildlife Service, the research council, Dept. of Transport and Trans-Canada Airlines. A large flock of gulls had just risen from the grass near the airstrip; a falcon was released from the gloved arm of its trainer. It went into the flock and downed one of the birds, the others wheeling off in fright.

For the past year the four birds have been on 24-hour duty at Victoria International Airport. They work on two shifts under a trained handler.

"Most days, now, you don't find a single gull around the airport," Beebe explained. "The falcons make an occasional kill, but this merely serves as a reminder to the gulls that an airport is an unhealthy place to hang about. It is still an experiment, but it seems to be working very well."

TRAINING A FALCON to attack only gulls, trainer Frank Beebe whirls a lure shaped like a sea gull. This was a difficult part of training, since falcons and sea gulls are not natural enemies and generally ignore each other

Now You Can Have a Lawn Mower That Flies

If you like to startle your neighbors, try the new airborne mower. It'll glide over your lawn using no wheels at all.

The mower rides on a cushion of air generated by a whirling impeller attached to the crankshaft above the rotary blade (visible in the photo at right). The air cushion holds the mower a quarter inch off the ground, just as other ground-effect machines like Hovercraft float on air.

Made by Toro Manufacturing Corp. of Minneapolis, Minn., the Flymo weighs only 30 pounds. Height of its 19-inch cut ranges from 5/16 inch to 1 7/16 inch, and is altered by changing spacers on the crankshaft extension. It's powered by a two-stroke, 2½-horsepower engine.

Only fingertip pressure is needed to maneuver the Flymo, according to the manufacturer. The price is $74.95.

Stick Men on the Slats

Ski enthusiasts who shy from active participation can have vicarious thrills with fully-outfitted figurines, just over a foot tall, which careen down slopes doing almost anything a skier can do—except sprain an ankle. A set of balances rights the figure automatically if it falls.

Mini-Ski, invented and designed by Bavarian goldsmith Professor Karl B. Berthold, is in great demand all over Germany where Mini-Ski racing is becoming the rage among winter sportsmen. They can enjoy the competition of downhill racing from the vantage point of interested observers.

LILLIPUTIAN SCHUSS BOOMER races down a slope. The weights extending from each side are delicately counter-balanced to keep the toy skier from falling

Army's New Dud-Picker

Small explosives that fail to detonate are safely retrieved for inspection with a dud-picker developed at the Picatinny Arsenal in New Jersey. Operated by one man, the vehicle has stainless steel armoring and a window composed of 15 sheets of plexiglass. In addition to a basket pick-up (shown), different types of "fingers" can be accommodated by the arm. The cab rides on a Spryte tracked vehicle.

Electric Drafting Table

Draftsmen can keep all parts of large drawings in easy reach on a new drafting table powered by two electric motors. At the touch of a knob, the top will adjust from 16 inches to 31½ inches in height, rotate through 360 degrees or change slope through 90 degrees horizontal to vertical.

Swiss-made, the $595 table is distributed by Reed Products, 4438 N. 20th St., St. Louis, Mo.

POPULAR SPORT in Germany is downhill racing with the wooden skiers. They can make all maneuvers of a human skier, including jumps (and without bruises)

THE INVENTOR of the Mini-Ski, Karl B. Berthold (standing, left), oversees craftsmen in workshop where hundreds of skiers are being produced each week

$3 ★ DRY BLUEPRINTER

By Art Youngquist

I WISH YOU HAD your own direct copy machine? They're expensive to buy but, believe it or not, I made one which does the job for only $3. All I have to do to make a copy is to place a sheet of special paper, plus the original, in a printing frame. Then after a few minutes' exposure to sunlight, and a brief development, I have as many exact 8½ x 11-in. copies as I want—for less than a penny per sheet.

The printer is ideal for making file copies of letters, running off a batch of posters, or reproducing plans. The samples at left

IMPROVED VERSION below has legs added so black-light fluorescents can slip underneath for sun-less printing. Place original face-down on glass, cover with copy paper, yellow side down, switch on light

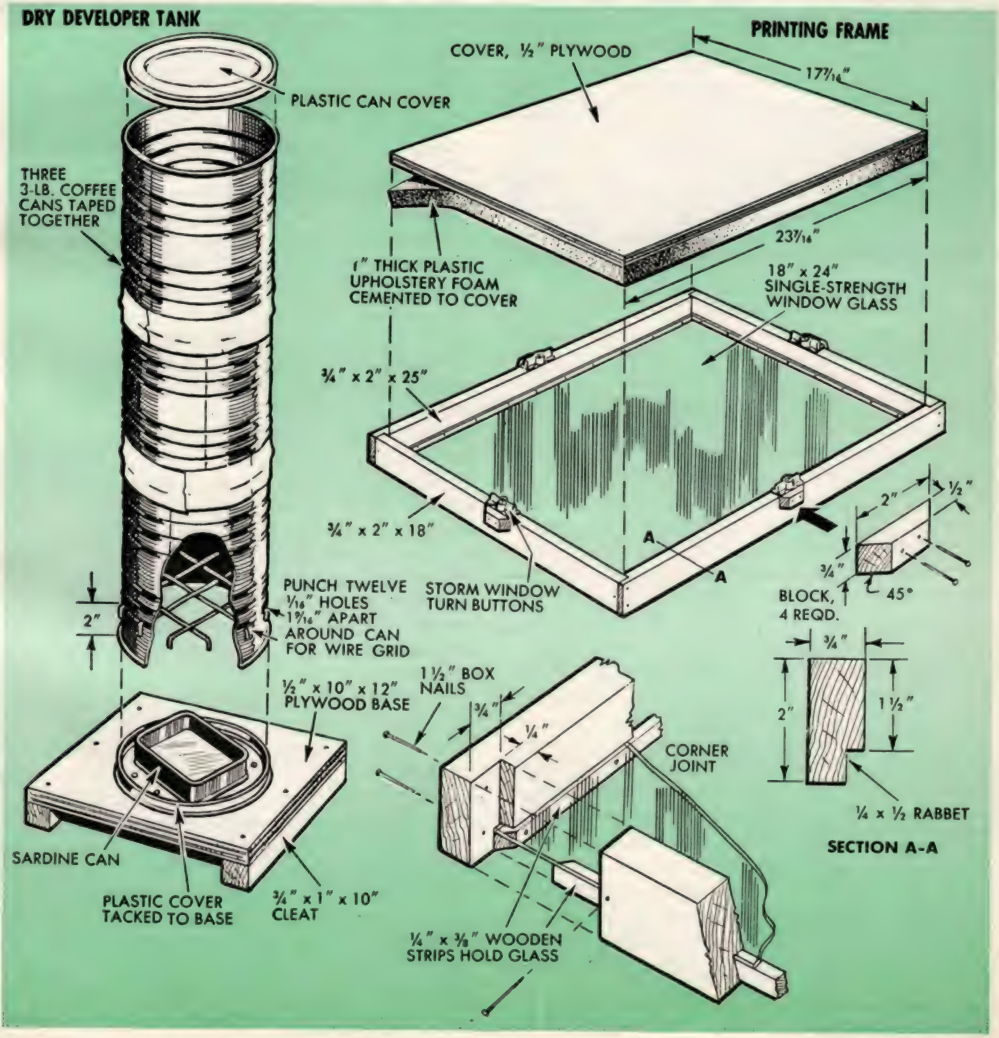
give an idea of what's possible. You can also "print" from flat objects, such as leaves or cut-outs. You get exact silhouettes by pressing the items between the frame's glass and the printing paper.

But I wanted to be able to use the copier without depending on sunlight, so I put the frame on four legs and placed two 20-w. black light (ultra violet) fluorescent lamps beneath. Since I had an old lamp fixture, the cost of the BL lamps boosted the initial cost only about $4.00. It's easier to calculate exposure time with the lamps then with sunlight.

The printer works with the greatest of ease because there are no messy chemicals, water or time-consuming drying process. In fact, the fumes of ordinary household ammonia develop the paper—dry and ready to use—in just a few minutes.

The paper is the same as that used by

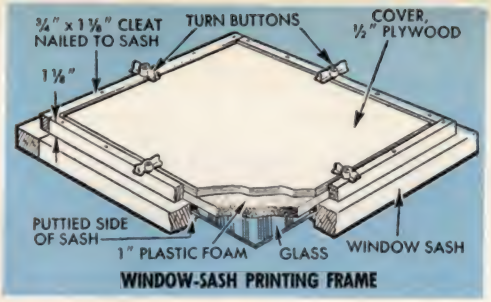
SMALL SIGNS such as this Pancake Day advertisement can be made in a jiffy. A neat job will result if you trace the original from a printer's type book



DRY DEVELOPMENT in ammonia fumes gives a ready-to-use copy in minutes. Two ounces of ammonia will last for nearly a full day's processing if care is taken to keep both top and bottom cans tightly sealed

industrial drafting departments to make the so-called white prints that are steadily supplanting old-fashioned blueprints. Drafting supply stores carry the paper in black, blue or brown line (in a variety of printing speeds) so you even have a choice for display work. The slowest black or blue line paper is best for home use because it is less sensitive to light and may be handled in any room having subdued, indirect illumination.

You can make the printing frame in any size. The dimensions given in the drawing are especially suitable because they allow four 8½ x 11-in. copies to be printed at one time on a 17 x 23-in. sheet of copy paper intended for standard "B" size engineering drawings. The frame may be constructed as shown or purchased ready made in the form of a single-pane window sash. The force exerted against the glass when the foam-padded cover is locked in place by the turn buttons makes it advisable to place the copy and the cover on the puttied side of the frame. That way, the glass will be supported by the frame,



WINDOW-SASH PRINTING FRAME

rather than just by the putty.

The dry developing tank is made from three 3-lb. coffee cans. The bottoms are removed and the cans taped together with 1½-in. adhesive tape. A bailing wire grid prevents the copy paper from falling into the ammonia can. One of the plastic covers that come with the coffee cans is tacked to the base to seal in the ammonia fumes and hold the cans upright. A second plastic cover seals the top can.

To ready the tank for use, remove the coffee cans and pour about 2 oz. of ammonia into a sardine can. Then immediately seat the cans in the bottom cover and seal the upper can. In a few minutes the cans will be filled with ammonia vapor. When the developing speed slows down, replace the used ammonia.

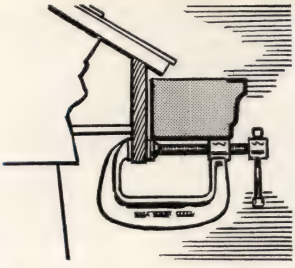
To determine outdoor exposure time, place the yellow side of the copy paper against the material to be copied, then lock up the frame. Cover the glass with a sheet of cardboard. Take the frame out in the sun and remove the cardboard, exposing the entire paper for about one minute. Then, using the cardboard as a shield, cover ¼ of the paper and expose the rest for another minute. Move the cardboard to cover half the paper and expose again for a minute. Continue making the test strip until the cardboard covers the paper. Make a note of the exposure times so that you can label the copy after developing it for about two minutes. The paper must be kept covered when carrying the frame in sunlight to prevent overexposure.

You will notice on your test strip that too long an exposure will wash out detail and make the copy hard to read. Too short an exposure will result in an overly dark background. The ideal copy will have strong lines on a white background.

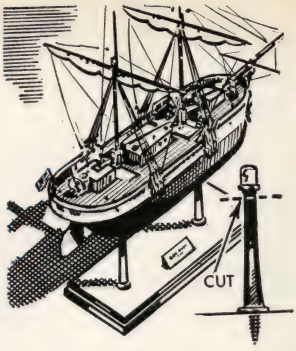
If you are using fluorescents, prop the frame about 7-in. above the lights. Exposure time will be about four times longer than in sunlight. Under normal useage, the ultra-violet rays should produce no harmful effects. However, where the printer might be used for prolonged periods, it is advisable to shield the lamps. ★★★

TAKE A HINT FROM READERS

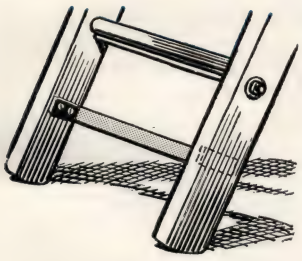
A PIECE of perforated hardboard cut so the holes along the edges form half-round notches, permits rubber bands to be used at the corners to keep papers in place on the "clipboard"



SMART STUNT used by a sheet-metal man to hang 40 ft. of gutter single-handed is to clamp C-clamps to the roof fascia board 20 ft. apart to support the trough while fastening it

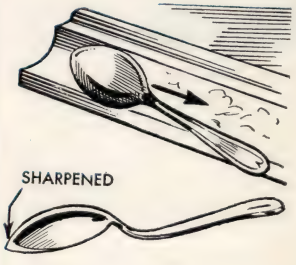


BRASS PLATED door stops make attractive pedestals for ship models. The rubber tip is cut off and the shank forced into a hole in the model. The other end is screwed into a hardwood base



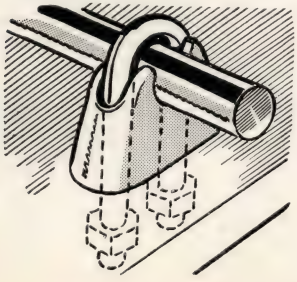
WHEN WORKING around muddy ground a built-in foot scraper on a ladder will make it a lot safer to use. Simply attach a length of flat steel with ends bent at right angles to form U

ELECTRICAL SPLICES in light duty wiring should be wrapped with aluminum foil before taping. The foil will eliminate corrosion and insure a good connection without the fuss and bother of soldering

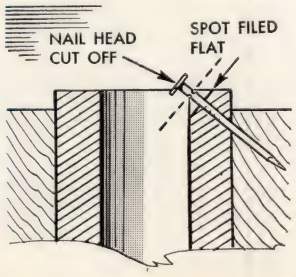


SCRAPING SOFTENED paint off a concave surface is difficult with most conventional scrapers. A perfect tool for the job can be made by sharpening the convex edge of a discarded teaspoon

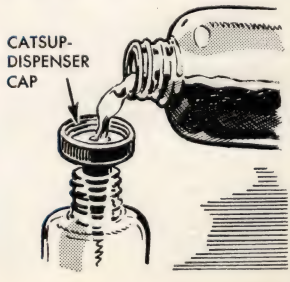
WIRE ROPE clamps make ideal "pillow blocks" for mounting an axle on sidewalk toys or other wheeled projects. The clamps are available in several sizes and grip better than U-bolts



LOCKING A METAL bushing in a wooden pulley can be done with a nail if you first file a flat so a hole can be drilled at a 30-deg. angle through the bushing. Head is later cut off nail



THE COMBINATION cap-and-spout top on a catsup or mustard squeeze bottle will serve in a pinch as a funnel for filling small neck bottles. Be sure to wash top before replacing it



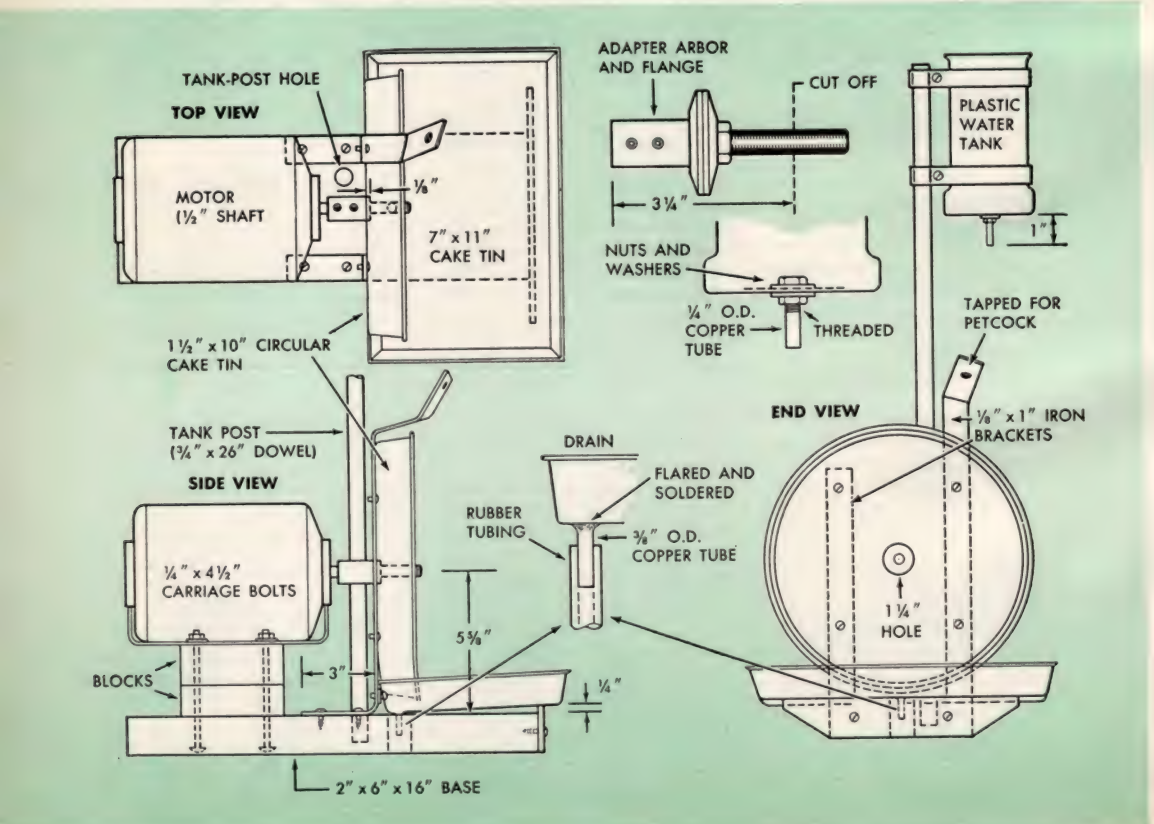
ODDS AND ENDS from your workshop scrap box can be used to build this efficient grinder-polisher unit

GRINDING

THIS simple and inexpensive home-made grinder-polisher will give you a good start in the popular and fascinating hobby of making gemstones. The process consists of grinding, sanding and polishing selected stones with progessively finer abrasives to produce a high luster.

Grinding wheels for this purpose must be silicon carbide and they are used wet to prevent them from glazing. With the equipment shown, a fine jet of water is directed against the side of the wheel just outside of the flange. The water quickly works its way toward the wheel edge and thus keeps it clean and effective. The water is ejected from the tiny orifice of a home oil-burner nozzle. This has a fine tubular screen that prevents clogging of the orifice. The nozzle can be removed instantly for cleaning, and the rubber-tube mounting can be pushed aside when changing wheels.

Cost and items to order: The total cost of this grinder-polisher is about $11 if you already have ¼-hp. light duty motor. Send to a mail-order house for the follow-

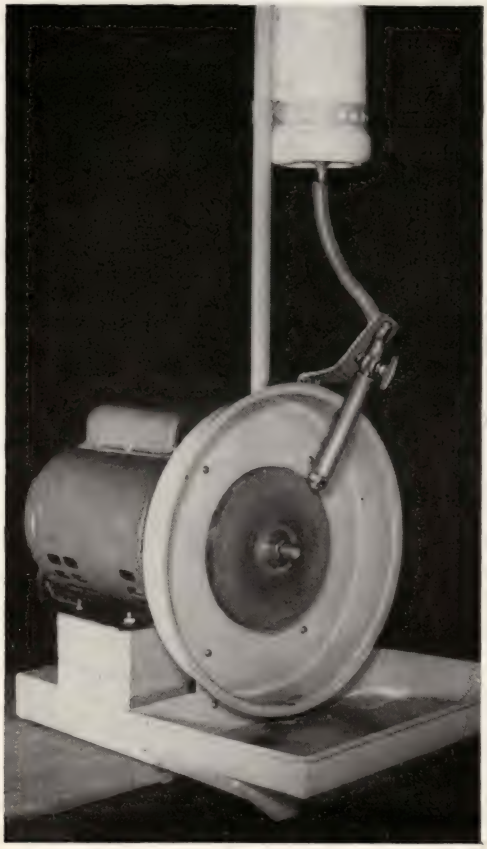


ing: (1) A silicon-carbide grinding wheel, 100 grit, size ½-1 in. x 6-in., with a ½-in. arbor hole. (2) Some silicon-carbide cloth-mounted sanding discs of 220 and 400 grit, which can be used wet or dry. (3) Some fine polishing powder such as levitated alumina, tin oxide or cerium oxide. (4) An adapter arbor to fit the motor shaft having a ½-in. threaded spindle. Other items needed can be purchased locally.

Motor mounting and brackets: Blocks to support the motor are bolted to the base to engage the slots of the motor base. A toggle switch should be located on the motor if possible, and if not, on the blocks that support it. Two flat-iron brackets support the spray shield and drain pan. The left bracket is bent to project above and in front of the spray shield to support a water-supply petcock. The front side of the brackets should extend ⅛-in. beyond the large diameter of the adapter arbor. The threaded end of the arbor is cut down so the total length will be about 3¼-in.

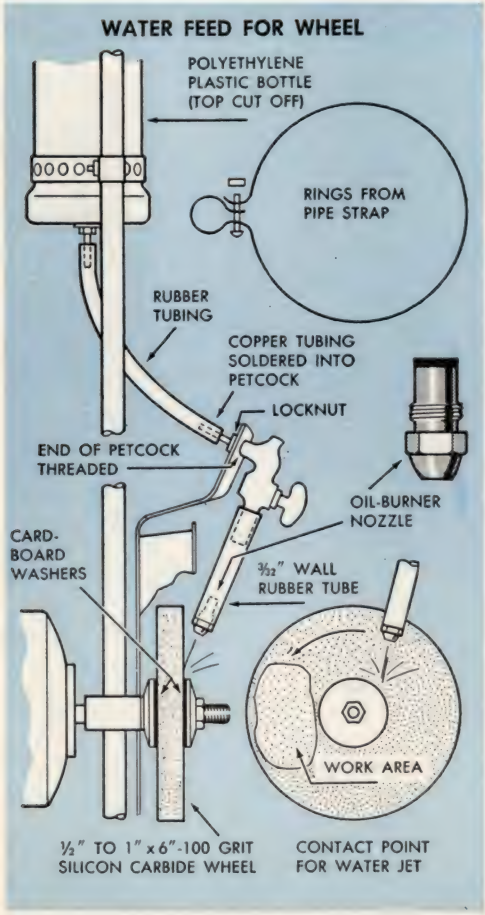
Spray shield and drain pan: The spray

DOP STICK serves as a convenient handle when polishing stone. Lower photo shows close-up of completed machine with a cloth-mounted sanding disc



THE MACHINE requires little maintenance, but occasionally the nozzle may become plugged, requiring its withdrawal from the rubber tubing for cleaning. The nozzle screen should be cleaned at the same time

CLOTH-MOUNTED silicon carbide sanding discs in any of several grits may be used, though most work can be handled with only two different grits. A 220-grit disc is used for rough sanding; 440-grit for finishing



shield has a 1¼-in. hole located at its center to provide clearance around the adapter arbor. An aluminum cake tin is ideal for this purpose because it won't rust. It should be about 10 in. in diameter and not less than 1½-in. deep. A 2 or 2½-in. depth is even better, especially for a 1-in.-thick grinding wheel. Clamp the spray shield in place on the brackets and prick-punch for four holes to take ¼-in. 6-32 brass machine screws. You can drill No. 34 holes through the brackets and tap the holes for the screws, or you can drill No. 28 holes and then use nuts on the screws. In either case the shield has No. 28 holes.

Drill screw holes near the bottom of the brackets for attachment of the drain pan. This is a 7 x 11-in. or slighty larger cake tin of almost any depth. For a drain nipple use a short length of ⅜-in. copper tubing flared at one and soldered to the bottom around a punched hole. Note how one side of the drain pan is slipped behind the lower part of the spray shield. A thin slat is nailed or screwed to the front end of the base to elevate the front of the drain pan. A 1-in. hole is bored through the base to accommodate the drain nipple centrally and permit slipping a rubber drain tube on it. The drain tube goes to a pail set on the floor.

Water-supply tank: Water is held in a small tank supported on a ¾-in. dowel about 26 in. long, which sets in a blind hole in the base. Use a polyethylene plastic bottle such as those containing household bleach. An ordinary tin can will rust, causing the water-jet orifice to clog constantly. The tank is attached to the post with perforated pipe-hanging strap which is bent carefully to fit both tank and post. It is then fastened with screws and nuts. A detail shows the attachment of a drain nipple on the water tank, using two thin brass nuts and washers on the threaded end of a ¼-in. copper tube to provide a leakproof connection.

Petcock and nozzle: Owing to differences in petcocks and spigots, your installation may differ somewhat from that shown here. In this case a spigot was used, the discharge end being threaded to engage a tapped hole in the bracket. For a hose connection a short copper tube was soldered into the spigot. A locknut was provided to hold the spigot securely. The other end was fitted snugly into a 3½-in. length of rubber tubing having an inside diameter of ⅜-in. and a wall thickness of 3/32-in., which gives the necessary rigidity. This size of tubing will fit snugly on the threaded portion of a home oil-burner nozzle, which has just the right-

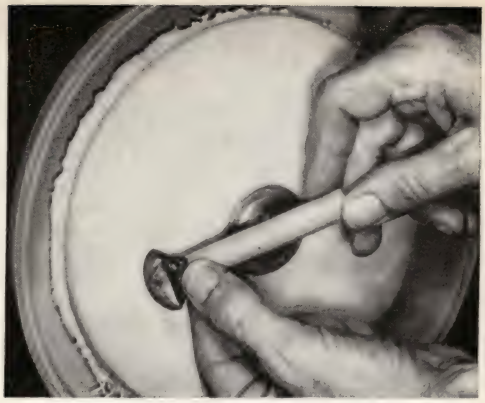
size orifice for a fine water jet. The threads of the nozzle should be solder-filled to make them leakproof.

All inside parts of the nozzle are removed except the tubular screen. You can buy a new nozzle for about $2 or get a discarded one free. The latter requires a very thorough cleaning for which you can use an oven-cleaning chemical. All traces of carbon and foreign matter must be scrupulously removed or you will be troubled by clogging of the orifice. Run a length of fine copper wire from a stranded lamp-cord through the orifice. If the screen fits too tightly inside of the rubber tube, you can assure the passage of water by filing tiny notches with a triangular file in the periphery of the solid end of the screen. Adjust the petcock or spigot, bending the bracket a little with two auto wrenches if necessary so that the jet will contact the wheel correctly. Connect the tank to the spigot with rubber tubing and then you will have the setup completed.

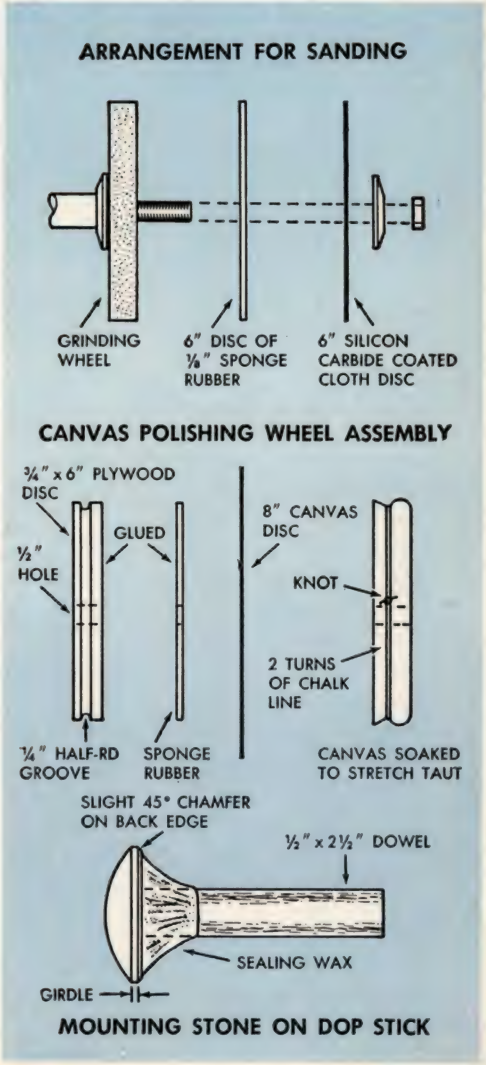
Making gemstones: Cabochons—the most popular kind of gemstones—are stones ground to shape and polished. They differ from baroques which are not ground to shape but only polished, and from faceted stones which have numerous ground and polished angular flats. In making cabochons you first grind the back of the stone flat, holding it against the grinding wheel by hand. Just before you start grinding turn on the water jet, and always turn it off when finished grinding. Water that contacts only a portion of a stationary wheel throws it out of balance and this may cause the wheel to break when rotating at high speed. You can also grind away most of the waste from the face of the stone by hand after which the stone is mounted on a dop stick. This is a ½ by 2½ or 3-in. dowel having the stone-mounting end cut off smoothly at right angles.

To attach the flat side of the stone to the dop stick, soften the end of a bar of sealing wax to the runny stage over a candle flame, taking care not to burn the wax. Apply the melted wax to the end of the dop stick liberally so it will be about ¼-in. thick around the side. Heat the flat side of the stone and keep the wax on the dop stick soft and sticky by holding both over the flame simultaneously. Then firmly press the end of the dop stick against the center of the stone. While holding the two between thumb and forefinger of the left hand to keep them in firm contact without moving, push some of the soft wax against the stone. While doing this keep the wax plastic. Add more wax

(Please turn to page 209)



POLISHING WHEEL is made by cementing a sponge-rubber disc to plywood. The assembly is then covered with convas held in place with chalkline. Charge wheel with a mixture of polishing powder



TAKING THE WOES

If the thought of getting "wrapped up" in your work has made you shy away from paper hanging, you'll be surprised to find that it's almost as easy as painting. Here a pro lets you in on his "tricks of the trade" to see that you start off right on your very first try

AFTER LANGUISHING several years as a stepchild of the decorating industry, wallpaper is making a comeback. This is evidenced by a sales rise of 60 percent in the last two years.

"Homeowners like the decorative variety they get with wallpaper," says Ted Blitzer, Somerville, N.J. paint and wallpaper dealer. "Paint goes on easily, and does a fine job, but for the most part you can only put it on in solid colors."

Another reason for wallpaper's appeal, particularly in older homes, is the fact that it will hide minor cracks and patches in the plaster or wallboard. In addition, it can make a room look taller, if you use a vertically striped paper, or wider, if you use a horizontal stripe.

But, by far the greatest reason for its new lease on life is the ease with which modern wallpapers can be hung. Since each roll (except for hand-printed "custom" types) is machine-printed, the design on one roll lines up accurately with the design on other rolls of the same pattern. Measuring and cutting, therefore, are held to a minimum. Furthermore, most manufacturers now offer a money-back guarantee if you happen to get paper from a lot that's not perfectly matched.

WITH PLUMB LINE hanging from mark near ceiling, use it to snap a chalk line. Or, with a yard stick or other straight edge, run a pencil mark along line

AFTER APPLYING PASTE, fold (but do not crease) top and bottom edges of strip toward center. This makes paper easier to handle and allows it to absorb paste

OUT OF WALLPAPERING

WHEN MEASURING for plumb line that will align first strip, work near the ceiling. You'll want a 1-in. overlap at the corner, so measure along the wall a distance equal to 1 in. less than width of the paper

With older paper, a blank edge was left around the paper to protect it in shipment from the factory. If the edges were crushed on the way to the dealer, it wasn't the pattern that was damaged, but a 1-in. to 1½-in. blank area. These edges had to be cut before the paper could be hung, and woe be it if they weren't cut straight.

But, since modern papers are shipped in heavy protective containers, the edges are precision trimmed at the factory. When properly hung, these edges butt together, giving a smooth blend of the pattern along the edges. In addition, the newer papers are stronger, more durable, easier to keep clean, and lower in price.

Modern wallpapers fall into three categories. There's a paper material (called washable wallpaper) that's coated with a clear wash-fast plastic. It sells for about 75¢ to $1.95 a roll. There's a paper material that has a vinyl coating on its surface. This is called vinyl wallpaper and sells for about $1.50 to $2.95 a roll. And there's a fabric material that has a heavy plastic finish. It's called a fabric wallpaper and costs generally $2.95 to $4.95 a roll, and up.

All have one thing in common, besides ease of hanging—they're all washable. Dirt, soot, and dust can be wiped off with a soft sponge dampened in a mild soap solution. An accidental splashing with water—even hot water—doesn't harm these coverings, as it did older wallpapers. Thus, they are ideal for use in kitchens, bathrooms, and even near showers.

Grease spots, too, are no longer a problem. Wallpaper dealers sell a cleaning agent that makes short work of grease. A dab of the agent is placed over a grease spot and allowed to remain there overnight. In the morning, the agent is scraped off . . . and so is the grease spot.

The difference in the three types of paper lies in their weight and durability, and the fact that the more expensive types offer exclusive patterns. The paper-backed materials are lighter in weight and, therefore, less durable than the fabric-backed. A recent development in this paper-backed material, though, has been the manufac-

WASHING WITH SPONGE and cold water removes excess paste that could dry on paper surface. Also minimizes chance of wrinkling. Use downward stroke

HANG FIRST STRIP from ceiling down. This strip, and all succeeding ones, must overlap ceiling and baseboard at least 2 in. Overlap is easily trimmed later

ROLL BUTT JOINTS TIGHT by running over them with regular seam roller designed for this purpose. Such rollers come with most kits of wallpapering tools

SMOOTHING BRUSH, also supplied with papering-tool kits, serves as a squeegee for smoothing the paper. Use firm strokes to remove extra paste, air pockets

ture of a pre-pasted product. Paste is applied to the paper backing at the factory. To hang the material, you just cut it, run it through a trough of water and put it up. No manual pasting step is required.

At present, only one of the fabric-backed materials (Birge) is pre-pasted. This product, which has a vinyl surface, combines the durability of fabric backing with the convenience of pre-pasted paper. It sells for about $4.35 a roll.

Hanging wallpaper involves five steps: preparing the wall surface, measuring and dropping a plumb line, pasting and hanging, smoothing and trimming, and washing.

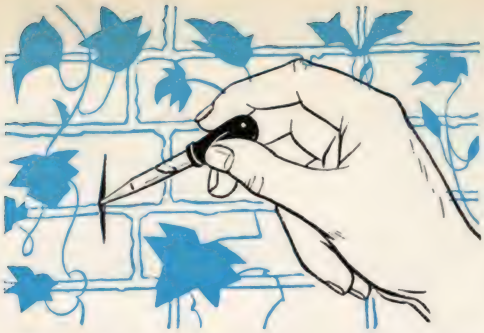
Before discussing these steps, one point must be made crystal-clear. These steps apply to hanging of machine-made papers only. They do *not* refer to hand-printed material, which is the finest and most expensive wall covering made. If you select a hand-printed paper for your home, *don't* attempt to hang it yourself unless you've had experience. Leave it to a professional if you want the most accurate job and one that will protect the investment you've made in this expensive product.

● *Preparing the Surface* — Wallpaper must be applied to a smooth, clean surface —whether plaster or wallboard. It won't adhere properly or look professionally hung on a wall that has excessive cracks and bumps in it.

Examine the wall carefully. All cracks and holes should be filled with spackling compound or patching plaster, and all rough spots or small bumps sanded smooth. If walls are of wallboard, look for protruding nailheads. Hammer them back into place until a small indentation is left in the wallboard. (But be careful not to hammer right through the wallboard.) Then fill the indentation with spackle.

After applying spackle or patching plaster, wipe it down immediately with a damp sponge. This helps it dry smoothly, without bumps or ridges. After the spackle or

SOMETIMES A BUBBLE PERSISTS, no matter how hard you brush. This means you missed a spot with the paste. To remove, first slit bubble with razor blade



AFTER SLITTING BUBBLE, soak area thoroughly with cold water and shoot paste into the slit with an eye-dropper. Finally, smooth the paper back into place

plaster dries, sand it flush with the wall surface.

Do this patching job carefully and with patience. *Wall preparation has a direct bearing on how the finished wallpapering job will look.*

If the wall has been previously painted with a glossy oil-base paint, wash it down with trisodium phosphate or six parts of water to one part of ammonia. Then, rinse with clear water. This de-glosses the wall, improving adherence of the wallpaper.

The question is often asked as to whether new wallpaper can be applied over old. It depends. For the best job, particularly if the old paper is loose in spots, you should remove it. If, however, the old paper is smooth and adhering tightly, and you wish to cut a corner, you can get a very acceptable job by putting the new paper over it.

"But," you reply, "I've heard that if you hang paper over paper, there's a good chance stain-producing fungi will start to grow between the two layers." This is no longer true, since modern wallpaper paste contains a fungicide.

Suppose, though, that you decide to remove the old paper. The only really effective way to do it is to use a steamer, which a wallpaper dealer will rent you, particularly if you buy the new paper from him. This steamer loosens the old paper and makes it quite easy to pull and scrape off with a putty knife or wall scraper. If the old paper has been painted over, break the paint film with very course sandpaper or a scraper.

When scraping be careful if the walls are of wallboard and weren't sized prior to hanging the old paper. A slip of the scraper could gouge the wallboard, making installation of new paper a tougher job.

This brings up another important preparatory step. Before hanging wallpaper, coat the wall or the old paper with wall size. This product, which is nothing more than a form of granulated glue, and which

FOR A SHARP CREASE in corner, tamp paper with brush bristles. Same procedure is used before trimming paper around door and window casings, etc.

AT BASEBOARD AND CEILING, first tamp the creases tightly with the brush, as above, then run the back of a pair of shears, or similar object, along creases

TRIMMING is accomplished one of several ways. You can pull paper from wall and cut with shears, or use a knife, razor blade or wallpaper cutting wheel

A Handy Chart for Estimating Number of Single Rolls Required

Size of Room	Single Rolls of Side Wall Height of Ceiling 8 feet	9 feet	10 feet	Yards of Border	Rolls of Ceiling
4 x 8	6	7	8	9	2
4 x 10	7	8	9	11	2
4 x 12	8	9	10	12	2
6 x 10	8	9	10	12	2
6 x 12	9	10	11	13	3
8 x 12	10	11	13	15	4
8 x 14	11	12	14	16	4
10 x 14	12	14	15	18	5
10 x 16	13	15	16	19	6
12 x 16	14	16	17	20	7
12 x 18	15	17	19	22	8
14 x 18	16	18	20	23	8
14 x 22	18	20	22	26	10
15 x 16	15	17	19	23	8
15 x 18	16	18	20	24	9
15 x 20	17	20	22	25	10
15 x 23	19	21	23	28	11
16 x 18	17	19	21	25	10
16 x 20	18	20	22	26	10
16 x 22	19	21	23	28	11
16 x 24	20	22	25	29	12
16 x 26	21	23	26	31	13
17 x 22	19	22	24	28	12
17 x 25	21	23	26	31	13
17 x 28	22	25	28	32	15
17 x 32	24	27	30	35	17
17 x 35	26	29	32	37	18
18 x 22	20	22	25	29	12
18 x 25	21	24	27	31	14
18 x 28	23	26	28	33	16
20 x 26	23	28	28	33	17
20 x 28	24	27	30	34	18
20 x 34	27	30	33	39	21

Deduct one single roll of side wall for every two ordinary size doors or windows or every 36 square feet of opening

SELF-ADHESIVE VINYL "PAPER" with fabric backing saves you trouble of applying paste. Paste is activated by running paper through "water box" on the floor

you can get from your wallpaper dealer, does two things.

First, it fills-in all small depressions that might suck in the wallpaper when the paste dries. It also helps to prevent the edges of the paper from coming loose.

Secondly, as we've indicated, it will make the paper easier to remove in later years. The steam from a wallpaper steamer will penetrate the size and loosen it.

One good reason for brushing size over old paper is this. The old paper can absorb water from the paste used on the new paper, thus impairing adhesion. Sizing seals the old paper and prevents this absorption.

Several methods are commonly used for preparing a *new* wall surface that has never been papered or painted. These include applying shellac or varnish. The best method, however, although the one which takes the most work, is to apply interior primer paint. Then apply wallpaper size. This will make it possible in later years to easily remove the paper and have a surface ready for painting should you decide on painted walls. Shellac and varnish don't offer this advantage.

● *Measuring and Dropping a Plumb Line*—Start at a corner. Measure in from the corner along the wall to a distance that's one inch *less* than the width of the wallpaper (photo, page 155.) If, for example, the wallpaper is 24 in. wide, measure in 23 in. from the corner to provide a 1-in. overlap at the corner.

Drop a plumb line from this mark and snap a chalk line on the wall or draw a straight line down the wall along the plumb with a yard stick and pencil (photo, page 154).

Now, measure from the ceiling to the baseboard at several points between the plumb line and corner to determine the maximum height of the wall to be covered. Measure the wallpaper so the first strip you'll be cutting is at least *3 to 4 in. longer than this maximum height.* Then, when you go to hang the first strip of paper, it will not only overlap the corner by one inch, but will also overlap the ceiling line and baseboard line. Each strip of paper you hang after the first piece should also be cut to overlap the ceiling and baseboard line, but *not* necessarily the remaining corners of the room.

The most important point to remember in hanging wallpaper is that this first piece must be absolutely straight. If it is straight, every succeeding piece will also be straight, since you will line them up with this first piece. Also remember that most walls are not straight, especially ceiling lines, baseboard lines and corners. This is why over-

(Please turn to page 220)

FARM TIMESAVERS

Fold-Away Handle

You can't mount a handle on the inside of a sliding barn door because it will interfere with the door's movement. A strap hinge attached under one of the cleats solves the problem. It folds out of the way when not needed or lifts easily to provide a handle for closing the door.

Corncob Polishes Plowshare

A plowshare can be cleaned or oiled by using corncobs as applicators. When saturated with scouring powder or oil and held with a spiked handle, the cobs provide a cost-free, easily replaceable tool for keeping plowshares in top shape. Thoroughly dried cobs are best for this purpose.

Fence Holds Sign

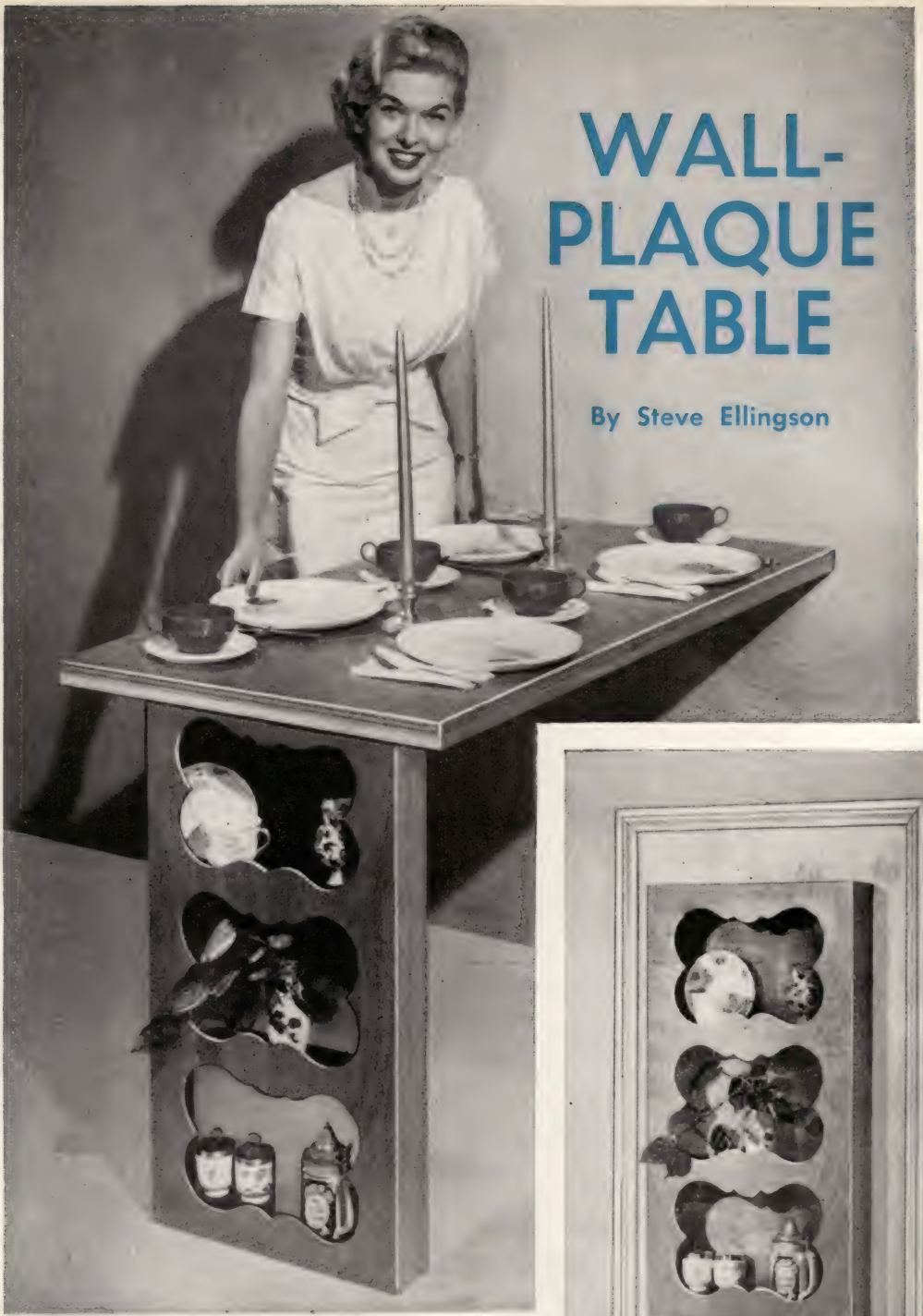
Signs advertising farm produce are easily displayed on roadside fences. Just nail a pair of projecting cleats to each end of the sign board, which should be about as wide as the distance between wires. The sign is inserted by simply spreading the wires apart.—*G. E. Hendrickson*

Bench Does Double Duty

Recently, I needed a sawhorse to help in cutting a tree limb into firewood. But I didn't want to spend time or money to build a horse since I had only infrequent need for one. Finally, I hit on the idea of inverting a sturdy, 4-ft. long garden bench. The standard V-shaped cut in the legs let me lay in two 6-in. boards to form a trough that would support short lengths for sawing. The boards didn't require nailing to hold them in place, so the bench was unscarred.—*Andy Vena*

WALL-PLAQUE TABLE

By Steve Ellingson



PULL IT DOWN and you have a handsome table supported by a wide shadow-box leg; swing it back up against the wall and your table becomes an attractive knick-knack shelf framed by a large hardwood panel. To avoid having to unload the shelves every time you lower the table, apply a few drops of cement to the bottom of each piece displayed to prevent it from falling

FINE FOR DINING, handy for homework and a space-saving boon to apartment dwellers, this swing-down table turns into a smart three-shelf wall plaque when folded against the wall.

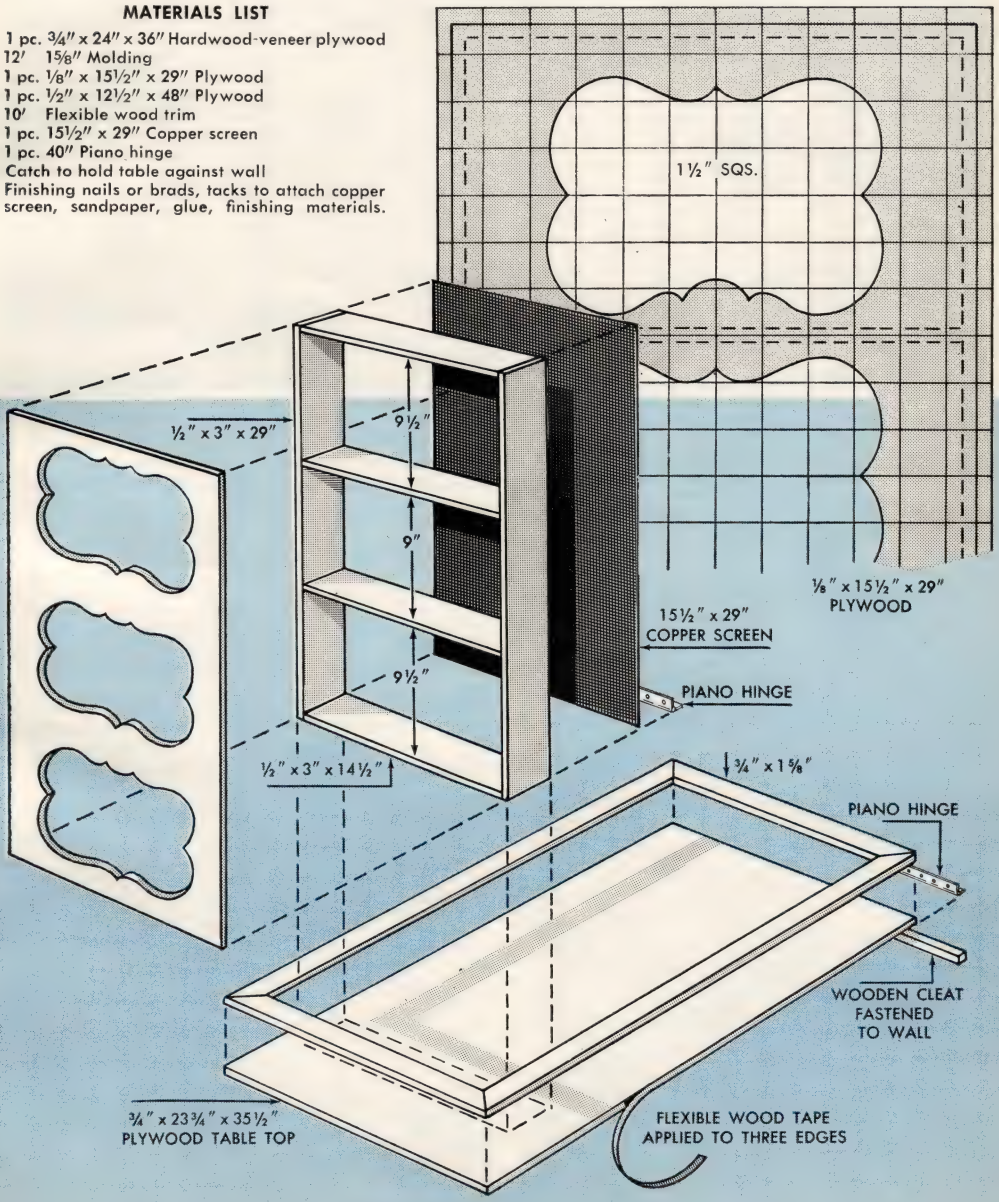
The exploded drawing, below, shows in detail how to cut and assemble the parts. Copper screen tacked to the back of the shelf-leg unit gives a novel see-through effect when the table is in use and also provides an attractive textured background for displaying knick-knacks when the table is folded.

While the choice of a catch to hold the table against the wall is a matter of personal preference, one obvious possibility is to fasten the magnet part of a magnetic cabinet catch to the outer edge of the table and screw the matching plate to the wall. This has the advantage of being both unobtrusive and easy to operate.

If you would prefer to work from full-size cutting patterns and don't wish to go to the trouble of enlarging the plans to make your own, simply send $1.00 to Steve Ellingson, Popular Mechanics Pattern Dept., Box 2383, Van Nuys, Calif., and request pattern No. 173. ★★★

MATERIALS LIST

1 pc. 3/4" x 24" x 36" Hardwood-veneer plywood
12' 1 5/8" Molding
1 pc. 1/8" x 15 1/2" x 29" Plywood
1 pc. 1/2" x 12 1/2" x 48" Plywood
10' Flexible wood trim
1 pc. 15 1/2" x 29" Copper screen
1 pc. 40" Piano hinge
Catch to hold table against wall
Finishing nails or brads, tacks to attach copper screen, sandpaper, glue, finishing materials.


1 1/2" SQS.
1/2" x 3" x 29"
9 1/2"
9"
9 1/2"
1/8" x 15 1/2" x 29" PLYWOOD
15 1/2" x 29" COPPER SCREEN
PIANO HINGE
1/2" x 3" x 14 1/2"
3/4" x 1 5/8"
PIANO HINGE
WOODEN CLEAT FASTENED TO WALL
3/4" x 23 3/4" x 35 1/2" PLYWOOD TABLE TOP
FLEXIBLE WOOD TAPE APPLIED TO THREE EDGES

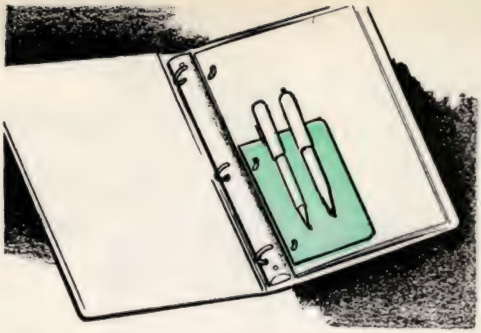
TRUNDLE TOY BOX works like a trundle bed, provides readily accessible storage without loss of floor space. With 1 x 6 sides and a ⅜-in. plywood bottom, it requires 4¾ x ⅝ in. wheels on ½-in. bolt axles

Solving

HOME PROBLEMS

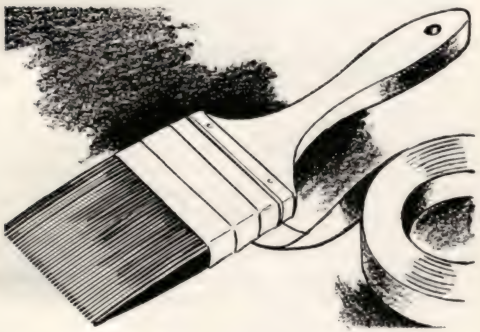
LINING WOODEN PLANTER with polyethylene helps prevent moisture from rotting, warping and staining the wood. Snip edges flush with top of tub and puncture the plastic at the weep holes in tub's bottom

THUMB INDEX your phone book or other reference books by clamping the pages ahead of the desired location and feeding them against a grindstone. Grind about ⅜-in. deep, add cellophane tape at base of slot

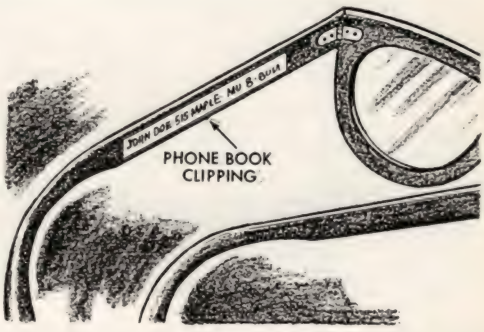


CLIP BOARD for your loose-leaf binder, which holds pen or pencil ready for instant use, is just a small sheet of cardboard with two holes punched to fit rings of the binder. It saves wear and tear on pockets

ENVELOPE FILE for clipped recipes will be much easier to consult if you fold the flaps upright and use them as label tabs. It's perfect for recipes, but works equally well for clippings filed in your workshop

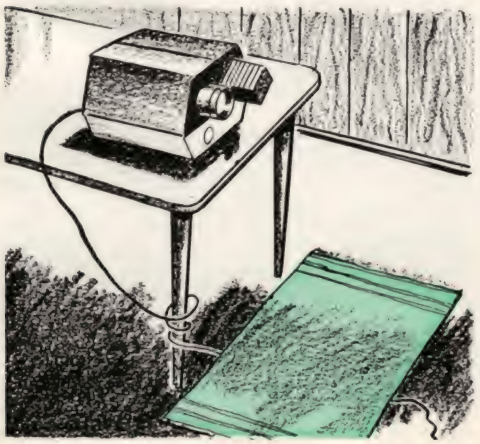


CLEANING PAINT BRUSHES will take less time and effort if you cover the metal ferrule with masking tape before you begin the job. After cleaning the bristles, just pull off the tape and throw it away

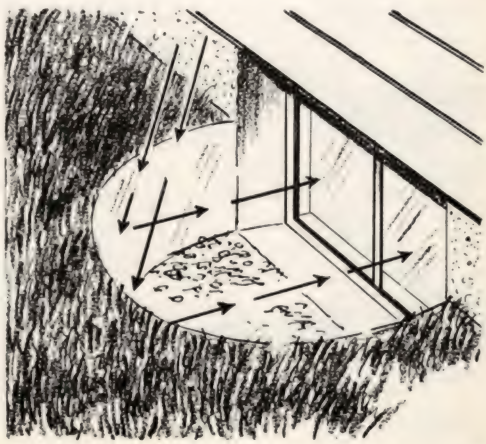


IDENTIFICATION label for glasses, pens or other small items can be clipped from the phone book. It contains your name, address and phone number in letters only 1/16 in. high and can be taped in place

WHEN PROJECTING your slides, it's a good idea to wind the cord from projector around table leg and place a small rug over cord going to the outlet. Prevents tripping over cord and damaging projector



INDIRECT LIGHTING for your basement brings the sun through the windows by reflection. Just line the walls of your basement window wells with aluminum foil, securing it in place with dabs of contact cement



New for Camera Buffs

By Arthur J. Maher

ULTRA-WIDE-ANGLE 28-mm lens fits or adapts to most single-lens reflex 35-mm cameras. Its 75-deg. coverage is almost twice that of a normal lens. Focuses from 3½ ft. to infinity at aperatures of F:2.8 to F:16. Costs $59.95. Spiratone, Inc., 135-06 Northern Boulevard, Flushing, N.Y. Case, $2.95 extra

KINGDON FILM WASHER is one of the fastest, most convenient we've seen. You leave the film in its developing reel, place it in the washer and then set it under a cold-water tap. Water immerses the reel completely, running out drainage holes in bottom. Costs $6.95 with an extension that raises capacity to five 35-mm reels, three 120 reels. Kingdon Photo Accessories, 1200 Madison Avenue, New York 28, N.Y.

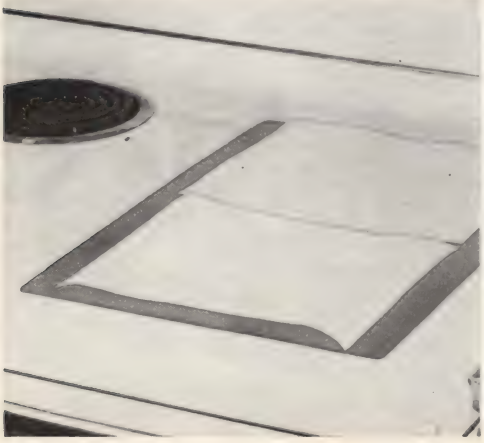
DARKROOM HINTS

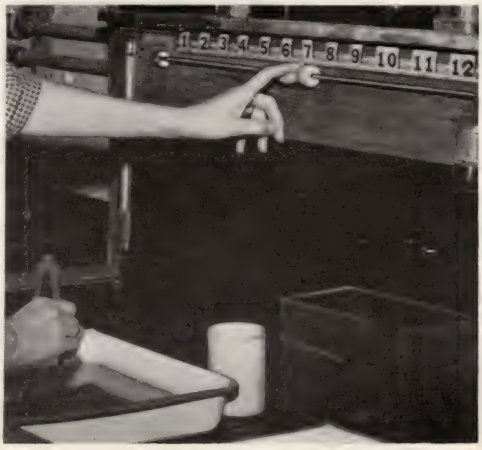
Ferrotype Prints in a Hurry

Glossy prints will generally dry in as little as 10 minutes time if you lay the ferrotype plates on the kitchen range with the oven turned on. Also works with some clothes driers, as well as flat-topped radiators and space heaters.—*Art Youngquist*

Developing Reminder

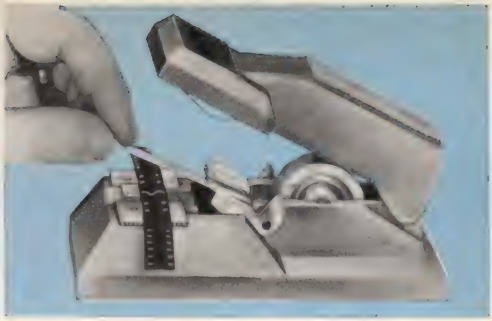
If you time your print developing with an old kitchen clock, this "memory scale" will remind you how long a print has been working. Install it near the clock, and slide the indicator button to the minute shown on the clock as soon as you place a print in the developer.—*C. Chatman*



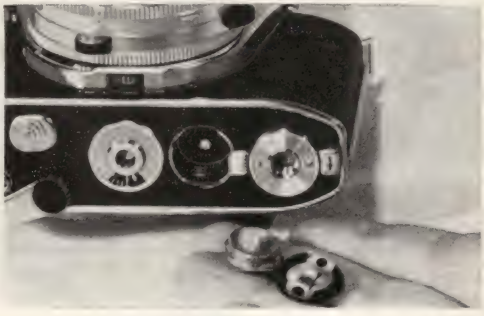


DESK-TOP SOUND PROJECTOR, called Minnorep, needs no electrical outlet, as it's battery powered. Shows standard 8-mm films with magnetic sound track. Goes on immediately when you raise lid, turns off when you close it. Transistor amplifier eliminates warm-up time. Operator can "freeze" the picture at any desired point. Weighs only 16 lbs., retails for under $360. Graflex, Inc., Rochester, N.Y. 14603

TRANSISTORIZED FLASH CIRCUIT in the Retina IIF 35-mm camera is powered by a button-sized PX-13 mercury battery like those used in cadmium-sulfide exposure meters. Pop-up flashgun built into camera takes AG-1 bulbs. Camera's other features include match-needle electric eye control, F:2.8 lens, shutter speeds of 1 sec. to 1/500 and self timer. Under $125. Eastman Kodak, 343 State St., Rochester 4, N.Y.



SPEEDS SPLICING OF MOVIE FILM: Automatic Dry Splicer tapes both sides of the film via wrap around, without your having to turn film over. Splicing tape is fed by a built-in roll. Makes an interlocking cut that is said to maintain original film rigidity and prevent loss of loop during projection. Available in 16-mm model for $12.95, 8-mm models for $4.95 to $7.95. DuPage Prods., Box 295, Lombard, Ill.



Graduate from Empty Jar

A wide-mouthed jar makes an inexpensive graduate for film processing. To calibrate for film sizes you use, place appropriate reel in the tank and pour in water until reel is covered by at least ¼ in. of liquid. Then transfer water to the jar and mark at the water level.—*Daniel Bousha*

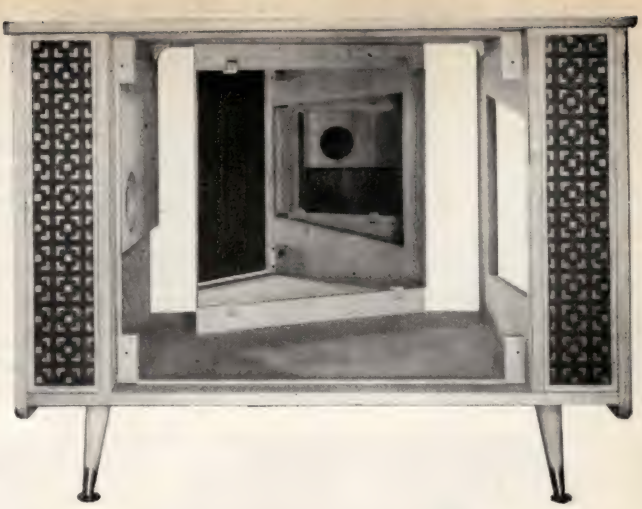
Instant Trimmer Setting

An aluminum bar, fitted with two short bolts to serve as registry pins (see insert), makes it easy to set the paper stop on your darkroom trimmer. Drill the base of your paper cutter to accept the pins at proper spacing for 4x5, 5x7 and other standard print sizes.—*F. L. Greenwald*

When not in use, this handsome cabinet gives no clue that it contains a whole new concept in home color-slide viewing

REAR-PROJECTION SCREEN CABINET

It stores your projector in an end compartment for quick set-up. The front doors swing wide to present a big TV-type screen

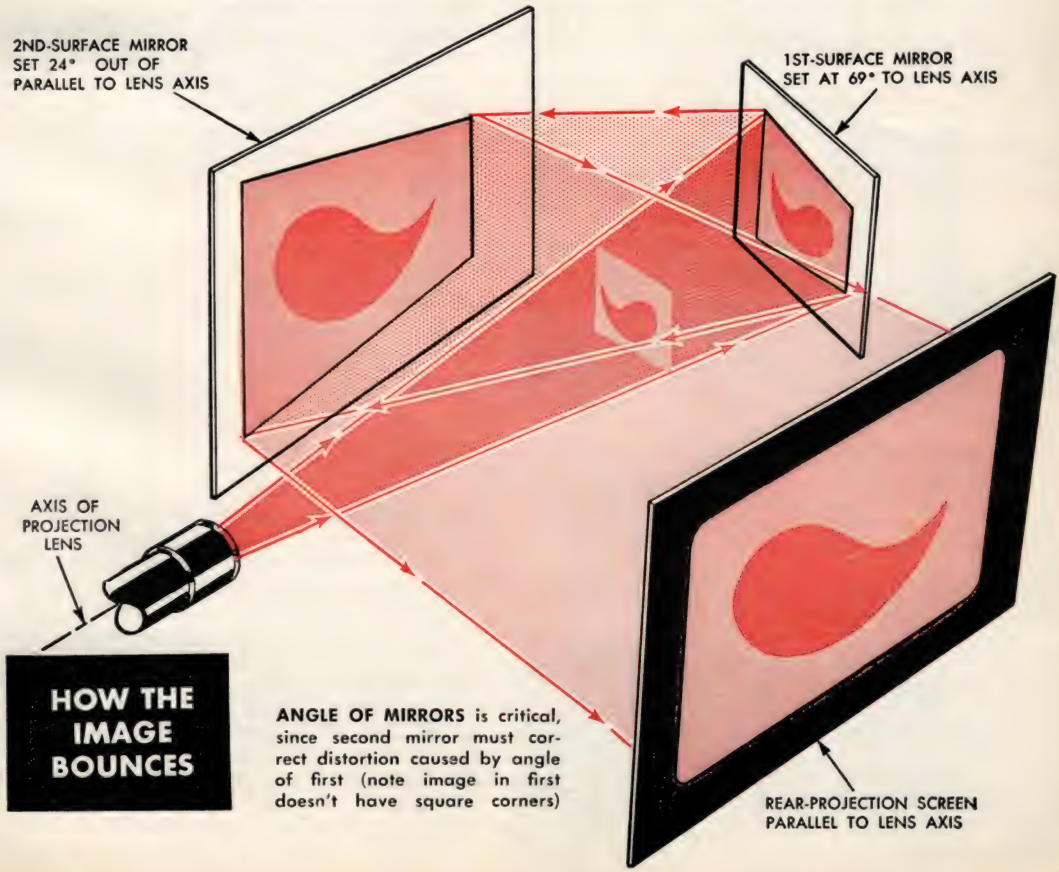


REMOVABLE SCREEN gives access to mirrors for cleaning, though once back and doors are added cabinet is pretty much sealed against dust. Interior assembly is complete, right. Image is projected through port in left partition and window in right one. Out-of-sight, here (but reflected at center), first-surface mirror is angled to bounce image back through partition window to second-surface mirror at rear of cabinet, then forward to screen. As shown in diagram below, you must project image backwards, since it would otherwise be reversed when viewed from the front of the screen. This is done by simply inserting slides backwards in projector

By Manly Banister

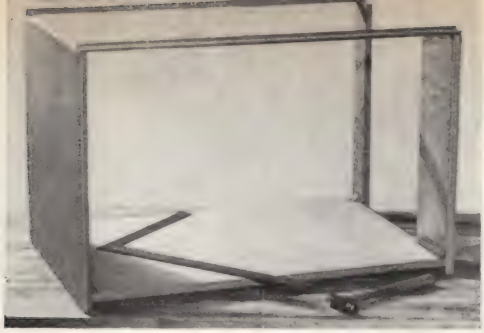
YOU'VE PROBABLY often wished for a more graceful way to share your slides with friends—one that would avoid all the fuss and formality of setting up a clumsy screen. Well, here it is—and, as a bonus, this system gives you a modern lo-boy for your living room or den. Slide shows can now be as easy and relaxed as television viewing. There'll be no more heads bobbing into the frame—or those distracting shadow-faces restless children like to make by thrusting their fingers into the beam. You won't even have to darken the room to see your slides in full brillance.

Like most good magic, it's done with mirrors, as shown in the photo above and the diagram below. The smaller mirror is a special type, silvered on the face instead of the back. The bigger one, at the rear of the cabinet, is a standard mirror you can buy at any mirror shop—but be sure it's made of ¼-in. polished plate glass; a win-

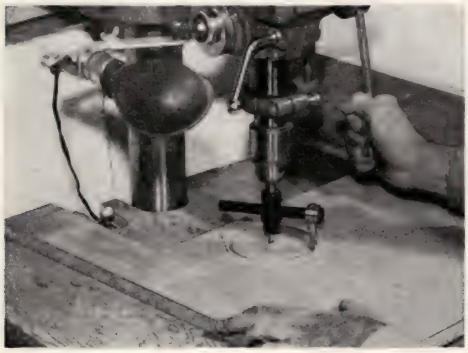

2ND-SURFACE MIRROR SET 24° OUT OF PARALLEL TO LENS AXIS
1ST-SURFACE MIRROR SET AT 69° TO LENS AXIS
AXIS OF PROJECTION LENS
REAR-PROJECTION SCREEN PARALLEL TO LENS AXIS

HOW THE IMAGE BOUNCES

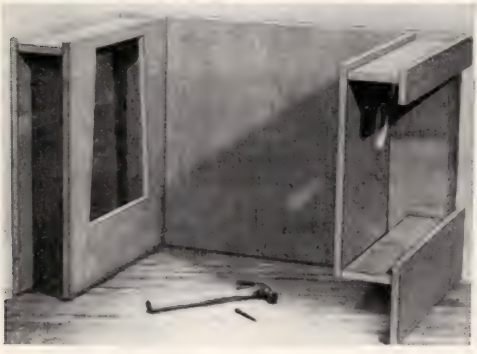
ANGLE OF MIRRORS is critical, since second mirror must correct distortion caused by angle of first (note image in first doesn't have square corners)



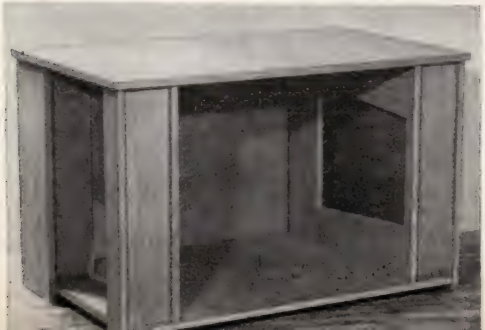
FIRST ASSEMBLY STEP is to nail ends to bottom, true with carpenter's square, tack temporary rails across top, add glue blocks and metal corner braces



FLY-CUTTER IN DRILL PRESS cuts clean projection port in left partition, though hole can also be jig-sawed and rasped. Particle board won't splinter



THREE-PIECE PROJECTION BAY is assembled with glue and nails before it's attached across gap. Window partition is added next, and top is attached (photo below) by nailing through ends into cleats on under-face, then securing with metal corner braces



dow-glass mirror is too wavy to produce an undistorted image. The screen is Kodak's black rear-projection type, mounted with the dull side out to eliminate reflections from the room's lamps or windows. In this big 20 x 24-in. size, the screen may have to be ordered from a mail-order optical house. Edmund Scientific Co. (Barrington, N. J. 08007) has it for $26.50 plus shipping charges. (They can also supply the 10 x 14-in. first-surface mirror, for $11.50.) That's not expensive as quality screens go, and the image is far more brilliant than you'd get with makeshift screen materials such as ground glass.

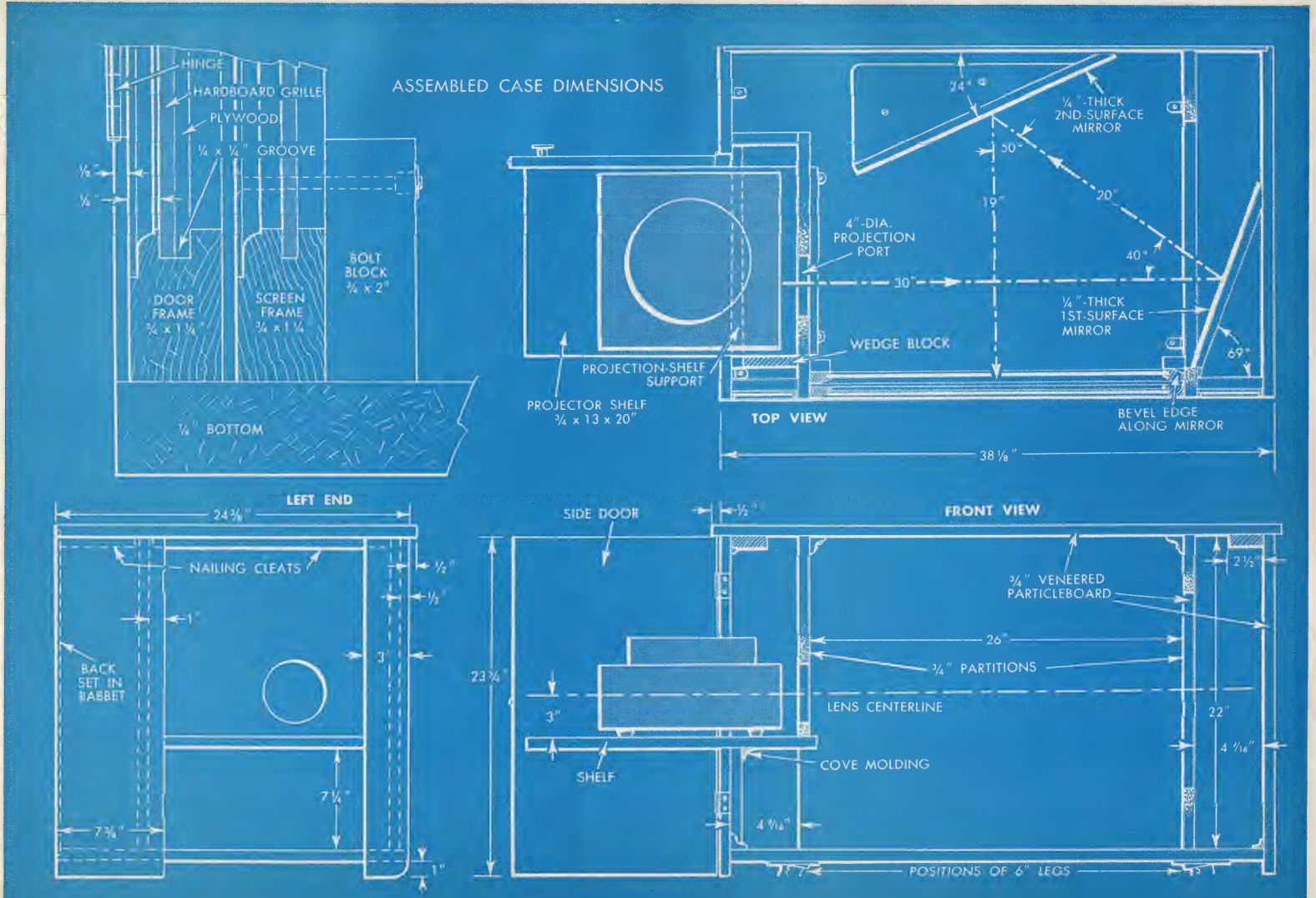
Built to the specifications on the following pages, your cabinet will be a precision optical instrument that you could even use for movies, if you don't mind the fact that printing (such as photographed signs) will appear backwards. An 8-mm movie projector has no provision for "flopping" the film. With slides, you simply insert them with the "wrong" face toward the lens; when viewed from the opposite side of the screen, the image is seen in its proper left-right relationship.

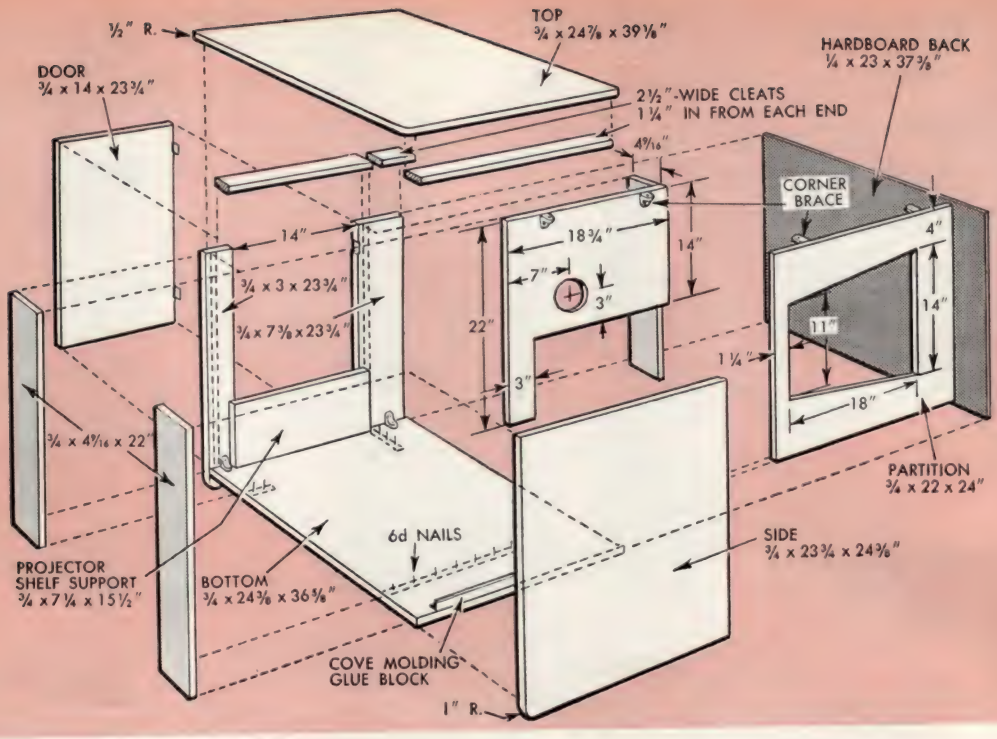
As dimensioned, the cabinet is just right for Kodak's popular Carousel (Model 550 or 570) automatic projector. Its 4-in. projection lens will blow up a standard 35-mm slide to the proportions shown in the bottom photo on page 166. The "margin" lets you show vertical slides without masking off top and bottom. If you take the larger, square "super" slides, you'll want to use a 5-in. lens in the projector—or invest in a zoom lens which lets you adjust for mixed slides. Since most good projectors now feature remote control of both slide-change and focus, you'll be able to sit "out front" with your audience.

With a little experimentation, you can adapt the cabinet to any other slide projector—or a movie projector. Since the latter requires a greater projection length to blow up the tiny 8-mm image, you'll have to provide an outboard bench of the proper height—and a bigger projection port.

The cabinet is constructed of ¾-in. particle board, shop grade, faced with hardwood veneer. It's cheaper than hardwood plywood and its stability and easy machining recommend it for this type of construction. You'll need one and a half 4x8 panels for the case and partitions. As with plywood, all exposed edges must be covered with a matching veneer tape.

You'll also need solid hardwood stock (to match the veneer) for the door and screen frames, and a set of four 6-in. hardwood legs, with angled mounting plates, that you can finish to match. To back up the hardboard grilles on the doors, you'll want ⅛-in. plywood in a matching veneer —or a prefinished hardboard. The mirror


ASSEMBLED CASE DIMENSIONS
HINGE
HARDBOARD GRILLE
PLYWOOD
¼ x ¼" GROOVE
⅛"
¼"
DOOR FRAME ¾ x 1¾"
SCREEN FRAME ¾ x 1¼"
BOLT BLOCK ¾ x 2"
¾" BOTTOM
4"-DIA. PROJECTION PORT
PROJECTION-SHELF SUPPORT
PROJECTOR SHELF ¾ x 13 x 20"
WEDGE BLOCK
¼"-THICK 2ND-SURFACE MIRROR
24"
50°
19"
20"
40°
30"
¼"-THICK 1ST-SURFACE MIRROR
69°
BEVEL EDGE ALONG MIRROR
TOP VIEW
38⅛"
LEFT END
24⅜"
NAILING CLEATS
½"
1½"
1"
3"
BACK SET IN RABBET
7¼"
7¾"
1"
SIDE DOOR
½"
23¾"
3"
SHELF
FRONT VIEW
¾" VENEERED PARTICLEBOARD
2½"
26"
¾" PARTITIONS
LENS CENTERLINE
22"
4 7/16"
COVE MOLDING
4 7/16"
POSITIONS OF 6" LEGS



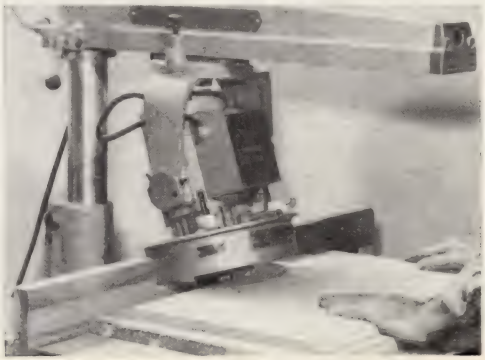
mounts can be plain (unveneered) ½-in. particleboard, or plywood.

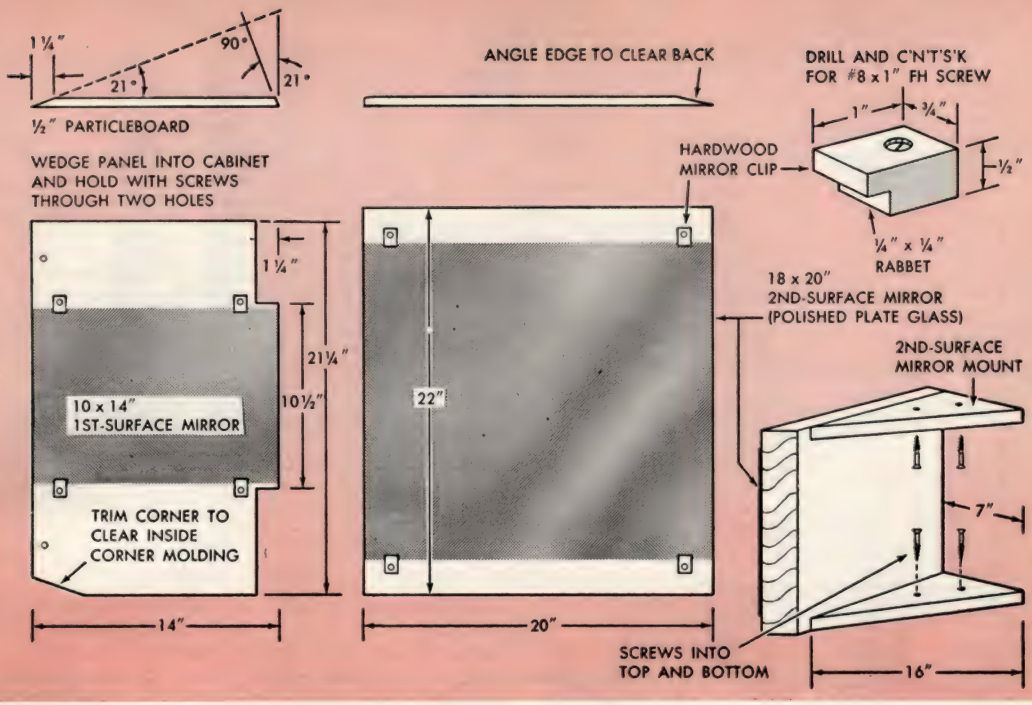
You needn't be an experienced cabinetmaker to build this unit. We've purposely kept construction simple by using butt joints tied together with glue blocks and standard metal corner brackets. And though the grille feature gives the piece its distinction, the effect is easily achieved with die-cut hardboard. You can paint the grille to match a dominant color in the room decor, giving the cabinet a look of having been custom made for your home.

When the basic construction is done, apply an over-all natural finish to all veneer faces, including the door panels, if you're using plywood here. The finish on the unit shown (which is cherry) involves three coats of Deft, sanded with 6-0 cabinet paper between coats, and the final coat rubbed with 3-0 steel wool. A good paste wax was applied for the final sheen.

After finishing, lay the hardboard grille panels over the front surfaces and add the trim molding (in the case of the narrow side panels) or the hardwood frames (in

CLEARANCE BEVELS are required by compact construction. To avoid fuzzing edge of projection cone, you must bevel rear face of screen frame's right stile where it laps first mirror. Bevels on mirror-mount panels (right) are critical for positioning and should be cut as sketched, next page. In photo, two-knife shaper head with square cutters is mounted on arbor of radial arm saw, panel is pushed past





the case of the two front door panels).

To fasten the mirrors to their mounting panels, you can either rabbet hardwood blocks as shown in the sketch, top right, or use commercial mirror clips. After a trial assembly to check optical performance with your projector (and to fasten the rear mirror-mount in position as shown in the photo, right) remove the screen and the first-surface mirror mount; also detach the second-surface mirror from its mount, but leave this mount in place. Paint the entire interior flat black—including both mirror boards, the inside end of the projector shelf, the edge of the projection port, the inside of the hardboard back panel, and the back of the screen frame. This eliminates reflections and adds to the brilliance and contrast of the screen image.

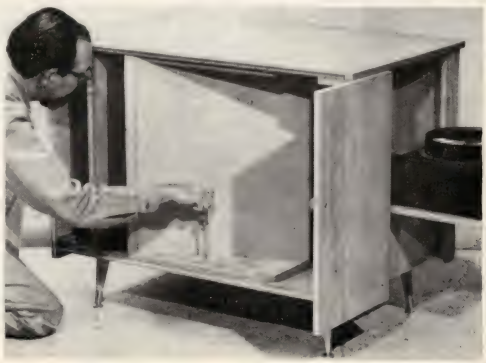
In handling the first-surface mirror, never touch the silvered surface with your fingers, and don't wipe it with a rag. This silvering is delicate; to remove dust, flick it lightly with a soft-bristle brush.

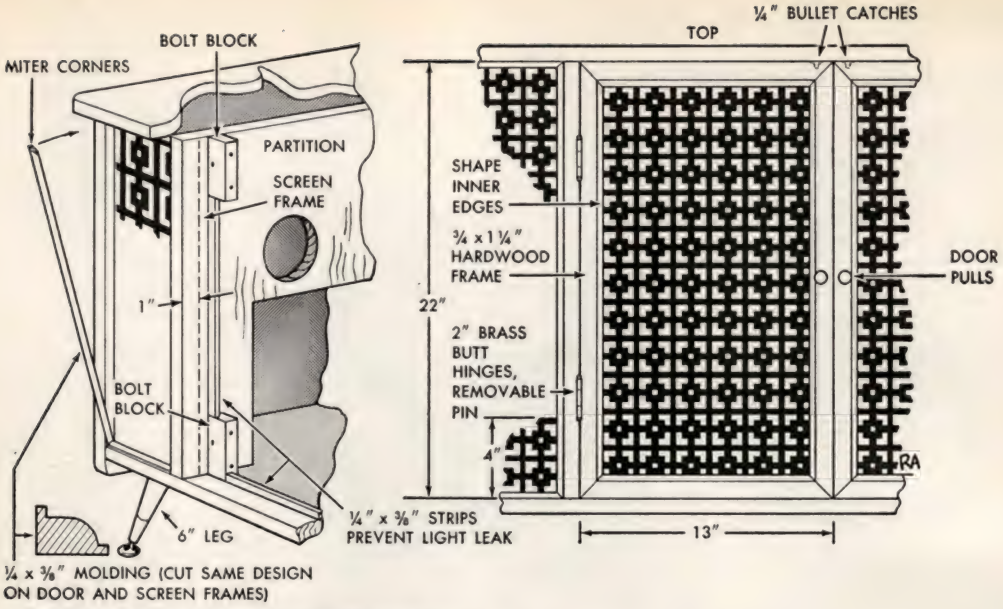
The frames for the front doors and screen can be either mitered (as detailed, next page) or mortised at the corners. If you intend to miter the pieces, the quickest way to cut the bead on the inner edge is on a shaper, before you cut the miters. But if you join the corners with mortise-and-tenon or slip joints, assemble the frame temporarily and shape the edges with a portable router, then disassemble to insert the panels. The cutter for the design shown is a $\frac{5}{32}$-in.-dia. Roman ogee bit.

Since you don't glue the screen panel in its frame, these joints need to be particularly strong; the frame must be removable, because once the back is bradded into its all-around rabbet, there's no other access to the interior of the cabinet. If you miter the screen frame, reinforce each corner with a screw, as at bottom of next page.

The projector shelf is a simple loose panel, but a small cleat (a scrap of mold-

ADJUST REAR MIRROR after first-surface mirror is mounted. Set up projector, aligning it square with cabinet. Move mirror mount till image is centered on screen as viewed from back, anchor with screws

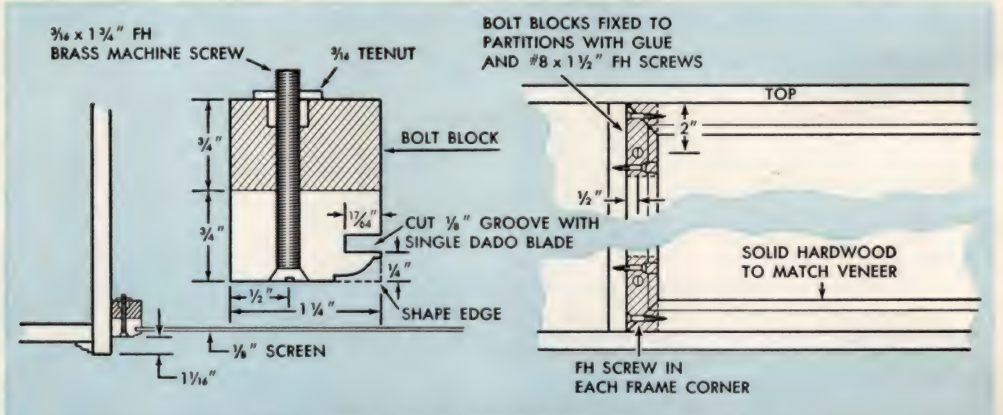




MOLDING TRIM completes the decorative side panels. Finish the veneer before fastening the hardboard grille with brads along its edges. Brads are covered by the molding, which needs no nailing—only glue

ing will do) should be glued across its undersurface to bear against the inside of the removable support panel. This prevents the shelf from being accidentally pulled free when you shift the projector for best position. The shelf, of course, is supported by the fulcrum action of the support, which jams it up against the lower edge of the partition. To keep the support board from falling inward, you wedge a block between it and the partition leg.

When the cabinet is not in use, simply lift out the shelf and the support, and slip the projector in under the partition for storage. The shelf is stored on end in the projection bay. When you close the cabinet's three doors, your self-contained "theatre" again becomes a handsome modern low-boy—until the next show. ★★★



INSTALLING SCREEN FRAME FOR REMOVABILITY

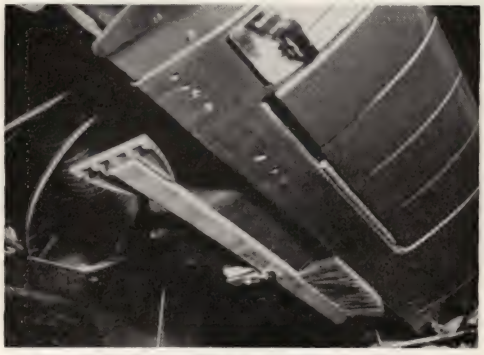
Melt Ice with a Seeder

To spread rock salt and other granulated de-icing materials evenly, use a cyclone-type seeder, which can be obtained readily from most mail order houses and rural hardware stores. If the spreader throws the material over too wide an area, attach a piece of canvas to each side to deflect the material downward.—*R. S. Wilkes*

A sure-fire way to keep the bottom edge of an upward-acting garage door from freezing to the floor is to tack an electrical heating cable—available in hardware and electrical supply stores—along the bottom edge of the door.—*F. Greenwald*

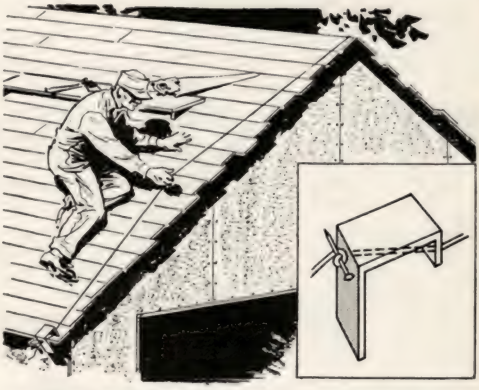
Clip Snow Brush Under Dash

Being too long for most glove compartments, snow brushes have an annoying habit of getting crammed under or between the seats, and caught in the car doors. By investing 10¢ in a spring clip, however, you can easily overcome this problem. Fasten the clip under the glove compartment as shown at right. The clip will hold the brush within reach at all times. You may have to use a spacer block or washers under the clip.—*W. Holman*



Snap a Line with Handy Clamps

Snapping a line over long stretches is a simple one-man job with a pair of these clamps. Make them by bending one leg of a flat steel corner angle so that the lip thus formed covers the inside hole in the straight leg. To use, run the line through the masked holes. A large knot secures the line to one clamp, which is placed in position. Slide the other clamp along the cord to its position, and snub the line around a nail. The strong downward pull created when tension is applied to the string holds the clamps in place.—*L. Kasper*



Knotted Sled "Tow"

Tied to a tree trunk or a stake at the top of your youngsters' favorite sledding hill, a rope that has been knotted every 18 in. provides a "tow" line that makes it a lot easier for them to climb back up a steep, slippery slope. By grabbing a knot as a step is taken, firm footing is assured along the return route.—*Frederick Harbet*

When using water-base paints, stop occasionally to wash out your brush or roller. This prevents paint from hardening in the tools, making them impossible to clean properly when the job's done.

—*Charles Wehking*

CONTROLLING YOUR CAR'S CONTROL CENTER

By Morton J. Schultz

CONCLUSION

Last month we found out how a distributor is supposed to work. When it doesn't, you can fix it —if you master the pro secrets offered here for the first time

THAT RED ARROW, above, points out an important feature on all American-built cars. Reference or timing marks, whether located on the flywheel, vibration damper or crankshaft pulley, let you check out the engine with a stroboscopic timing light. This light flashes each time a spark plug fires. Aimed at the whirling marks, the light beam "freezes" them so that they seem to stand still in relation to a pointer.

If the spark plug fires early or late, these marks will be either to the right or left of the pointer, depending on the direction of engine rotation. It's essential, of course, that you know the correct timing specs for your car in order to run this check.

Ignition specifications, particularly those applying to the distributor, vary from car to car—and from year to year on the same car—and maybe even from model to model on the same year car. Unfortunately, these specifications can't be listed here—there'd be no room for anything else. However, the manufacturer of your car is, as usual, ready to help. Before attempting to tune your ignition system, shoot off a letter to his department of technical service and ask for the ignition specs for your year and model. Or if you're in a hurry, you might give your local dealer a buzz and ask his service manager for these figures.

There are also excellent service books, such as Chilton's and Motor's Auto Repair Manuals, which give these specifications. Either of these should be available at your local library or service station.

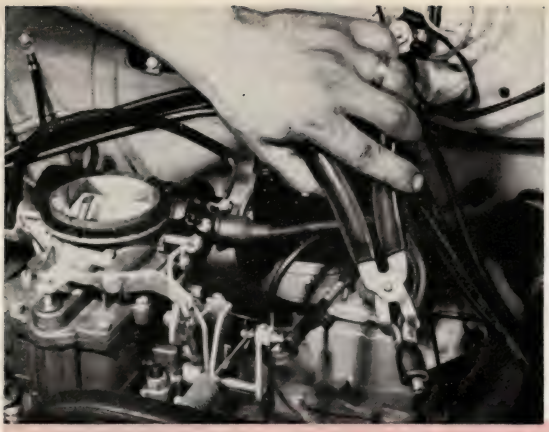
The specifications you'll need are: distributor breaker point gap, dwell angle degrees, ignition timing (and the location of the timing marks if you haven't already found them), idle speed in r.p.m., the firing order of your engine so you can hook up high tension wires in their correct place and, if you're going into the spark plugs (you should for fine tuning), the recommended electrode gap and torque specifications.

To begin tuneup of an ignition system, make sure you have a good battery. Without one that's fully or nearly fully charged, you can get false indications that may leave you confused or lead you to erroneous conclusions. So, unless your battery's relatively new or you know it to be in good condition, test and charge it, if necessary.

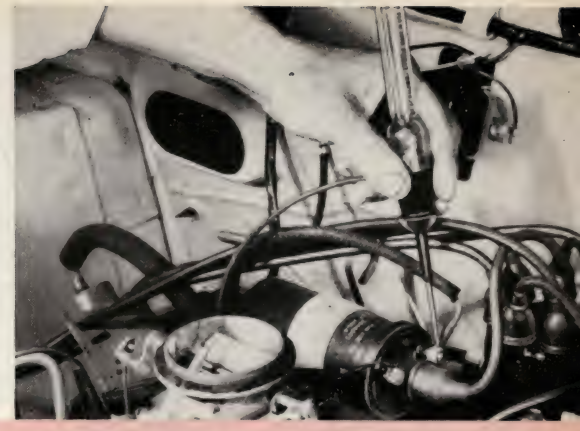
You must now make sure that the primary circuit and the secondary circuit through the coil are operating as they should. The quick test shown at top left, next page, will tell you about the primary. If no spark or a weak spark appears, you have to pin the trouble to either primary or secondary. And here we get into a problem.

The trouble area from a repair standpoint is the part of the primary ignition circuit from the battery to the coil, especially that portion of it which goes beneath the dashboard.

In most of today's cars, that circuit starting at the battery goes through a relay, through resistors (either wire-type or ex-



TO CHECK COIL, pull its high tension lead from center tower of distributor and hold it about 3/16 in. from clean ground on engine. If fat spark jumps gap when engine is cranked, primary coil is okay



PINPOINT TROUBLE as being in either primary or secondary by using troublelight. Hook it to ground and probe distributor side of coil. If it flickers when engine is cranked, primary is probably okay

ternal), through the ignition switch, and from the ignition switch to the coil. It's a mass of wiring harnesses and hard-to-get-to spots.

Too many people are fooled by the simplified wiring diagrams that often accompany articles and instructions. On paper it looks as smooth as a baby's skin—in practice it's one of the most complicated areas of the car.

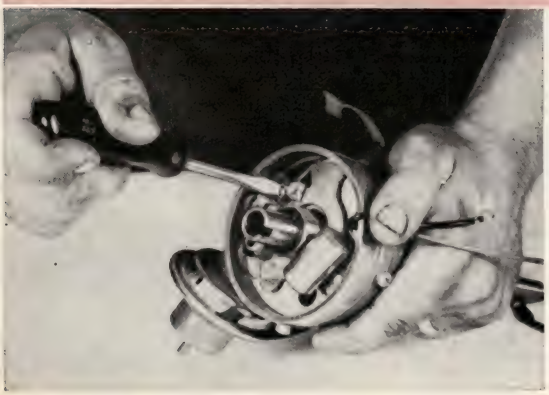
I had one Plymouth mechanic tell me, for example, that it took him five hours to trace a problem to the ignition switch and replace that switch on a Plymouth. And this guy knows the car as well as you know your own name.

Does this offer little hope for your being able to tuneup and repair the ignition system yourself? Not at all. Most of your tuneup is done from the coil on, and especially in the distributor. Seldom will you find anything wrong from the coil back to the battery, although it *can* foul and you should test it.

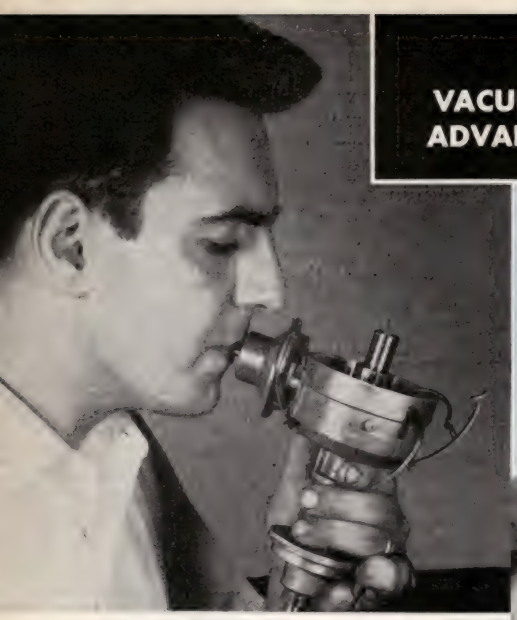
Thus, I suggest that if you run into a problem in this area, you tighten down all connections (at the coil and battery, for example), push in all wires to make sure they're seated, and check the hot battery cable for broken insulation. Then test again. If the trouble's still there, it's best to leave repairs to a qualified mechanic who knows your car, unless you're thoroughly familiar with it yourself or have the courage and time to tackle it.

The test you use to pinpoint the trouble as being in either the primary or secondary is made with a troublelight (as shown above right) or, for greater accuracy, a voltmeter. The troublelight should flicker

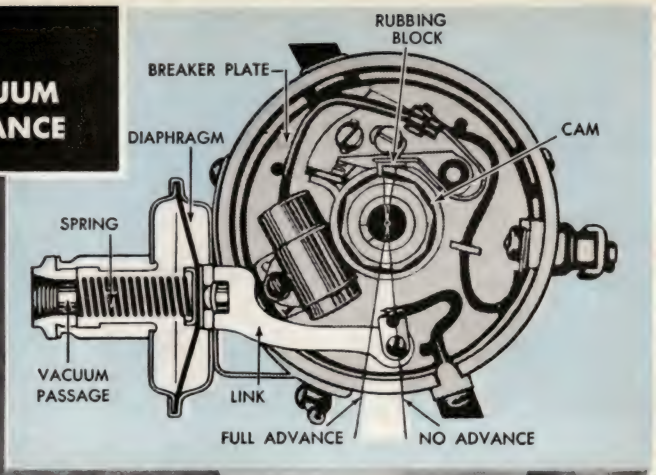
DISTRIBUTOR DISASSEMBLY starts with the contact points. They're usually held by one screw. If they look in bad shape, or have seen 10,000 miles of use, replace them with new points; they're easy to install



CONDENSER, too, is held by only one screw. Though you can test this part, it's so inexpensive that it's not worth buying a tester, unless you do a lot of repair work. It's best to put in a new condenser



VACUUM ADVANCE



ADVANCING THE SPARK is job of vacuum advance unit attached to side of distributor. It shifts ignition timing according to engine vacuum and load by moving breaker plate, as shown in sketch. At cruising speed, points close a bit sooner than normally, because engine vacuum pulls against the spring, drawing link forward. Bad diaphragm or spring can be checked by sucking on nozzle while watching breaker plate (above). Newer units must be replaced by unscrewing them (right) and slipping link free of breaker plate

off and on as the distributor points open and close. If it does, the reason you're getting no spark or a weak one is most likely in the *secondary* circuit— the coil, distributor cap, rotor, or even the condenser.

If the light remains off as the engine's cranked, the primary circuit is open or the distributor points are not opening properly. And there's one other possibility—if the light remains on, the distributor points probably aren't closing properly.

Be aware, though, that troublelight tests give indications only and can't be taken as gospel. To test most accurately, connect a voltmeter from the battery's hot post to the battery side of the coil. (Be sure the voltmeter is connected positive to positive or negative to negative.)

Throw a jumper wire from the distributor side of the coil to ground, completing the circuit. The jumper wire takes the distributor out of the circuit and gives the

REMOVE BREAKER PLATE by unscrewing body bolts and lifting free. Do this when plate itself is worn and needs replacing, or to get at centrifugal advance

INSERT SCREWDRIVER between flyweights of centrifugal advance unit. If you can pry them apart easily, the springs have lost tension; replace flyweight unit

same condition as would occur if the distributor points remained closed at all times. Turn on the ignition switch.

The voltmeter should read about 6.9 *or less* (it depends on the battery charge) for all cars, whether 6 or 12 volts. The reason this reading is the same, or nearly so, for the 12 volt system as for a 6 volt is that in a 12 volt a resistor (or resistors) is used in the circuit between battery and coil to reduce the amount of voltage available to the coil. This is actually done to protect the distributor breaker points.

Look at it this way. Ignition coils used in 12 volt cars can be considered specially designed 6 volt coils. If there were no resistor to reduce voltage, the points would receive double the normal current and would soon burn up.

If, then, the voltmeter reading is more than about 6.9 volts, you'd best get mighty suspicious of the primary circuit from battery to coil. It could be a defective battery cable, bad relay, burned out relay-to-ignition switch wire, bad ignition switch, malfunctioning ignition - switch - to - coil wire or a faulty resistor. Again, let it be said—if this test shows a problem, repairs are best left to a mechanic.

There's another part outside of the distributor that's often critical. It's the coil, and it's true that you can't be absolutely certain it's bad without checking it on a coil tester. If you're suspicious, then maybe you can borrow this tester or get a shop to check it for you. Sometimes, though, you might be able to tab a bad coil by the process of elimination.

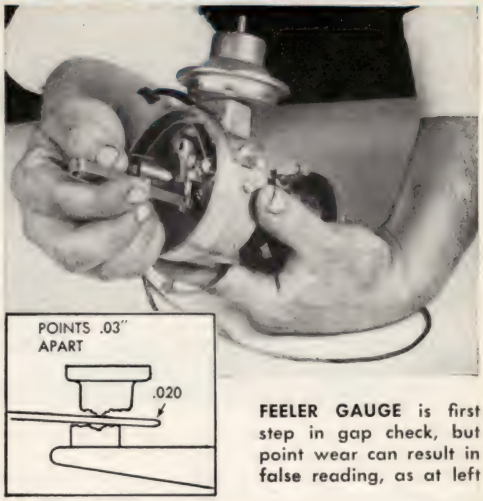
A bad or weak coil shows up in only two ways—either the car won't start, although the engine will revolve quickly, or there'll be a *high speed miss* (and there's been a rash of these lately, to judge by Auto Clinic letters). This is when you accelerate to, say, about 45 to 60 miles per hour and suddenly the car starts to buck. When you drop down in speed, the acceleration straightens out.

It's possible that the coil is breaking down under high speed—can't take the load. If the condition continues, it will eventually lead to a burned out coil which you'll have to replace. A high speed miss, though, can also result from other things, such as a partially clogged fuel filter, cracked cap or worn spark plugs.

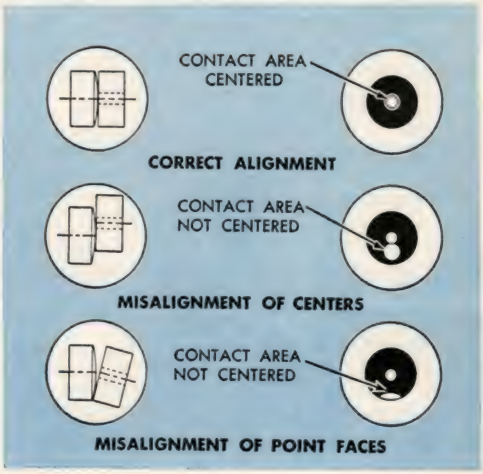
By the way, although a coil might be a suspect, be aware that in most cars there's a resistor on the coil that can go bad, giving symptoms of a bad coil. That resistor is lot cheaper to replace than a coil, so maybe you'd be better off getting a new one and seeing what happens.

The preliminaries are over. Now, let's start having some fun by getting into that

CHECKING THE POINTS

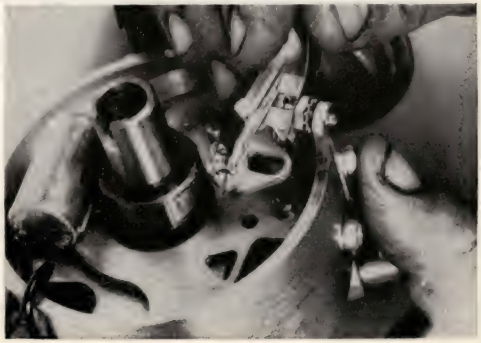


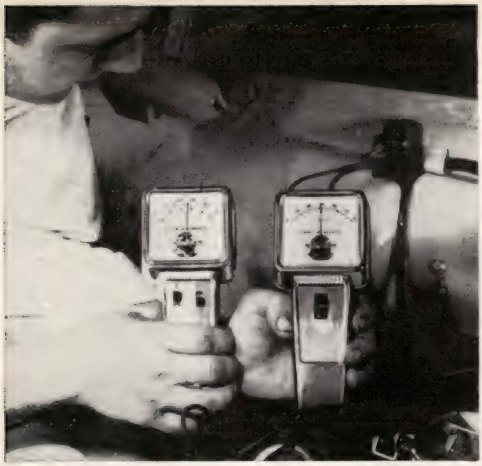
FEELER GAUGE is first step in gap check, but point wear can result in false reading, as at left



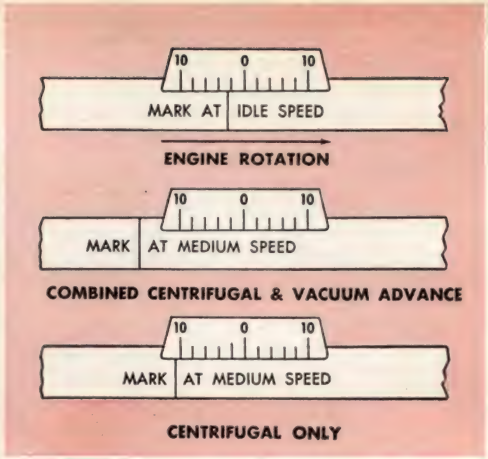
CHECK POINT ALIGNMENT by turning cam till points are closed; check by eye which of these three ways they make contact. Lower two call for realigning

MODERN POINTS are one-piece sets, machine-calibrated at the factory. Replacing them is simply a case of dropping in new unit, tightening a screw





DWELL METER and tachometer are used in double hook-up to test points for resetting. Primary lead of each is connected to distributor terminal on either coil or distributor. Other lead goes to ground



TIMING LIGHT can also be used to check centrifugal and vacuum advance. When you slowly speed engine up to 1500 r.p.m., timing mark should move in opposite direction to engine rotation in both tests, as shown

distributor to fine-tune it. It's always best to take the distributor out of the car for this, but there's a trick you can use which'll make it easier to put back.

Before unscrewing the bolt that holds the distributor in place, pull the ignition wires from the cap. Take off the cap and select a spot somewhere on the car, such as a bolt on the firewall. Tickle the starter until the front (contact) end of the rotor lines up on this mark. When you reinstall the distributor, you'll again line up the rotor contact on this spot so your initial timing won't be way out of whack. A rotor can only slip onto the distributor shaft one way, so there's no worry about this.

OK—unbolt the distributor and bring it over to the bench. Take the cap along.

Although you might find some differences in placement of parts, all distributors used in modern cars are much alike and, thus, disassembly for tuning won't vary much from unit to unit. (The distributor in our photos is one of the most common now in use.) Follow the steps shown in the disassembly photos on pages 175 and 176.

A faulty vacuum advance unit can be a cause of excess fuel usage, as well as engine knock. When a car's running at part throttle, the compression pressure is low and gas burns pretty slowly. This means that the plugs have to fire extra early to give all of the fuel mixture a chance to burn. Otherwise a lot of gas that's fed to the cylinders passes through without being burned. Thus, if the vacuum advance doesn't permit sparks to fly when they should, because it's defective, you're paying for gas you're not using. In the sucking test shown on page 176, the plate should move perceptibly when you create a vacuum. If not, the unit is shot.

Older type units can be taken apart, repaired and adjusted. Newer types, however, are sealed and must be replaced.

There are two other parts of the distributor that might go bad, although it seldom happens. These are the breaker plate and the centrifugal advance.

The breaker plate, if worn and loose, can materially change the breaker point cam angle. Test it by trying to move it with your fingers. If especially loose, tighten the body screws. If still lose, replace it.

In the absence of a distributorscope, test the centrifugal advance unit (its job is to advance the cam in respect to the distributor drive shaft movement) by removing the breaker plate, as shown on page 176. At this point, it's always a good idea to check to see if the cam and distributor shaft are worn. You can examine the cam to determine if the lobes (the points between the flats) are badly worn or damaged. If so, replace it and the shaft.

If the cam checks out, test the shaft simply by moving it backwards and forwards. There will be some play, but shouldn't be much. If there is, the shaft's worn and should be replaced.

One tip-off to a worn shaft is a badly corroded rotor. Corrosion on the rotor contacts indicates that corrosive gases are being allowed into the distributor body because of a worn shaft. Both the rotor and shaft should be replaced.

OK—put everything back together making sure all screws are tight. Install a new condenser and a new set of points.

The points are the heart of the system, and you should now check their gap and

(Please turn to page 216)

King-Size Plastic Sheets Spatter-Proof New Siding

WHILE IT TAKES extra time to wrap their homes in polyethelene, Daniels and House, California builders, have found it saves hours of clean-up time in the long run by protecting redwood siding from spatters while overhang soffits were being plastered. Major wrap-ups such as this are considered worthwhile, of course, only when the exterior is to be left a natural-wood finish, and where the siding has to be applied before overhead plastering work can be done.

Old-style wood lathing strips or similar thin scrap stock may be used to secure the plastic at its top edge. Heavy planks, bricks or stones weight down the bottom. Wood strips should be tacked around the doorways to keep the cut-out entrance ways from tearing off.

The wrapping treatment isn't limited to large construction work. For example, a small sheet of plastic taped over a bath tub will catch plaster spatter from walls or ceiling. The plastic sheeting is surprisingly inexpensive and can be re-used many times.—*John Stapp*

NEXT MONTH IN SHOP AND CRAFTS

★ **REPAIRING DAMAGED BOOKS.** A few minutes of your time, a little paste and you can repair minor damage to most books in your library. Serious damage may require a complete rebuilding job, but even this is a simple task if you follow the instructions in next month's issue. For an insider's tips on repairing and rebinding, get the February issue of *PM*

★ **SHOP VACUUM CLEANER.** If you want a big-muscle cleaner that will pick up heavy shop debris, don't miss this shop special in the February issue. Using a five-gallon grease can as a tank, you can make a vacuum cleaner that compares favorably with $45.00 commercial models. All you need for this cleaner is the motor from an old household vacuum cleaner

★ **REMOTE WIND INDICATOR.** When winter winds blow, you'll be able to tell which direction they're blowing if you build this simple wind indicator designed to give an indoor reading. The heart of the unit is a rotor which reads wind direction and sends a signal to a remote unit which can be mounted anywhere in your house. It's a low-cost luxury project

★ **SILENCING SQUEAKY FLOORS.** A hardwood floor may rate tops in appearance and still sound off with annoying squeaks whenever you walk across it. If you'd like to put a permanent gag on that floor, pick up a copy of next month's *PM*. It describes several ways of correcting such under-foot noise and you're sure to find one suited to your problem

AUTO CLINIC

Q Can you figure out why Cadillac recommends running the air conditioner compressor a good deal of the time during the winter?—C.E.K., Md.

A Caddy's automatic temperature control system is designed to dehumidify and cool in the summer and dehumidify and heat in the winter. The key word is *dehumidify*. For warm, *dry* air inside the car during the winter, the air conditioner compressor has to be on to dehumidify that air while the heater controls its warmth.

Q My 1963 Corvair with 3000 miles on it has been throwing fan belt after fan belt. What's causing this problem?—L. W. C., Mo.

A In all likelihood you're using a belt not recommended for Corvair. It's probably the same size, which is the deceiving factor. To offset Corvair belt-busting, you must use the belt made by Chevrolet (part no. 3780981), and it must be torqued to specification.

Q The power steering unit of my 1961 Ford stiffens so badly in cold weather that I can hardly drive it until it warms up. I found that moisture collects in the unit and forms ice. Is there anyway to combat this?—R.H., Ill.

A Some power steering fluids will do this when used in a car for which they're not designed. These fluids foam and cause condensation that turns to ice in freezing weather. I suggest you warm the car up thoroughly so all ice is melted and drain the system of all old fluid. Then, add genuine Ford Type A power steering fluid (available from a Ford dealer) and run the car with this fluid for a hundred miles or so to completely flush the system and get any remaining moisture in suspension. Drain the fluid again and discard it, and refill once more with the Ford fluid.

Q Some of the trim molding of my car is scratched and tarnished. Is there any repair other than replacement?—W.E.C., Hawaii

A Something relatively new is metallic tape made to "refinish" tarnished or damaged trim, both interior and exterior. It goes right over the original trim and is said to be practically undetectable. Try a local auto parts supply house.

Q My Austin Healy is always kept tuned to the point of perfection. Yet, when cold weather hits I always have a lot of trouble starting. I've installed new points, condenser, hotter plugs and a carburetor . . . and the battery is in good shape. Is there something inherent with this car which makes it hard to start?—W.P.B., Conn.

A There are two factors surrounding the Austin which often contribute to hard starting in cold weather. First, you have to determine whether your fuel pump is electric or mechanical. If electric, your problem could be failure to follow the correct starting procedure: turn on the ignition and wait. *Keep your foot on the gas pedal.* You'll hear a clicking sound, which is the pump pumping up the fuel. As soon as this clicking stops, pull the choke out and start the car. If you hear no clicking and you know the pump is electrical, or the pump keeps clicking for a long period—say, more than five clicks—then the pump has gone bad and should be replaced. If you don't have an electric fuel pump (or you do and this starting procedure doesn't work) I'd check compression, since valves are a critical area with the Austin. If compression is too low, bad valves can cause hard starting.

Q My 1959 Volkswagen is experiencing carburetor freeze up. On a cold, damp day in particular you can actually see ice on the pipe coming off the carburetor. This leads, of course, to frequent stalling. What can I do?—H.B.R., Pa.

A This is not a new problem for the VW, but it's one that needn't occur. Muffler replacement is a frequent occurrence with this car, and it's this replacement which lies at the root of the icing problem, especially if it's done by a mechanic not too familiar with the VW. The one who does the replacement job often puts the wrong gaskets on the heat riser pipe. The wrong gaskets have a small inner diameter that prevents a full blast of heat from reaching cold spots, thus leading to the icing condition. The correct gas-

kets carry part number 111251263A. There are two to a set. Each has a diameter of one inch, which is the correct size. Settle for no others. If you get a set that has one gasket with a one inch diameter and the other with a smaller diameter, ask the dealer to replace the small one. By the way, in doing the job the muffler has to come off. It's always a good idea to have the heat riser tube cleaned out, since rust in and around it could restrict flow of hot gases.

Q My 1961 Pontiac Bonneville won't start after being run a while and stopped. Yet, it starts immediately on the coldest mornings. After I go to start it when it's hot, my starter hardly turns the engine over. If I let it set for 10 to 20 minutes, though, it starts right up. I've had the battery checked and there's nothing wrong with it. A friend of mine with a 1959 Chrysler has the same problem. Ever hear of it?—J.C., N. Y.

A Boy, I'll say I have. One out of every five letters we receive reports the same problem, and it all centers on cars with big engines. The cause, in most cases, is a build up of carbon in that engine. When it happens, the compression approaches as much as 200 p.s.i. when the engine's at operating temperature. The "small" starter just can't take the load imposed by such high compression until the temperature cools down and the pressure is relieved.

Now, there are certain things you can try in order to get rid of the problem before resorting to a carbon-purging job. First, make sure the starter is in good shape and is putting out according to specifications. Have the engine tuned by the book, making certain that timing is right on the button. If this doesn't help, buy some Top Engine Cleaner. Pour it in as directed. This might just purge the engine of enough carbon to relieve the situation, although it might take several cans of the stuff added over several months to turn the trick. (Give it at least three cans over a three month period before giving up.)

Oh, yes, there might be one other thing causing the problem. Make sure the manifold heat control valve is working properly. If it's stuck tight, heat could be causing excessive vaporization of fuel when the engine's warm and, therefore, hard starting.

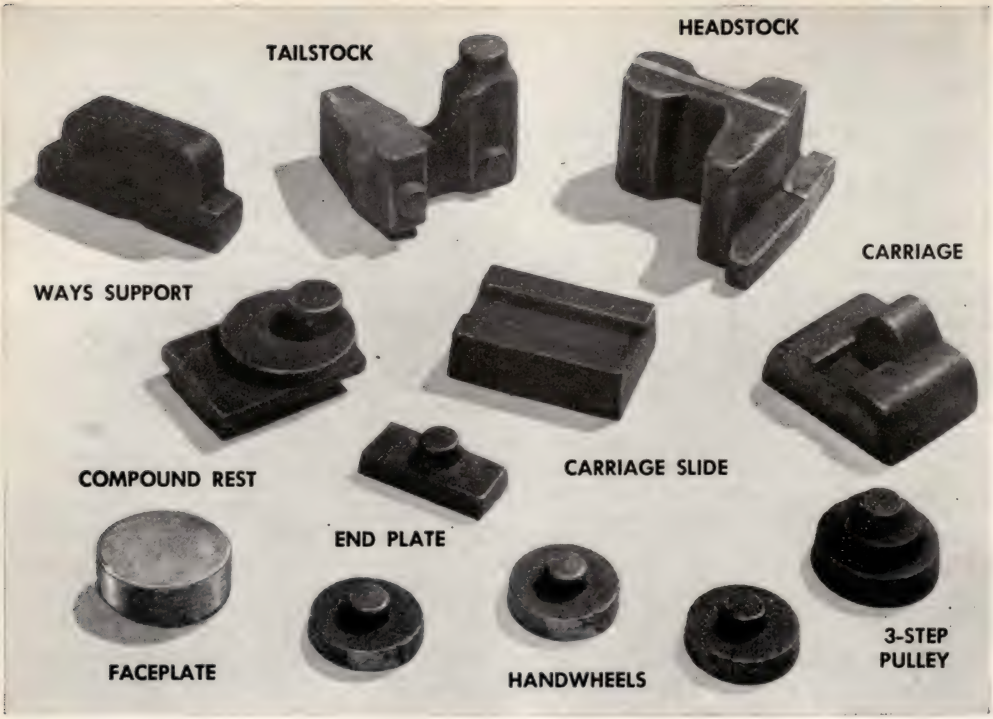
Monthly Service Tips

★ If you've been hearing rattles from the vicinity of the steering column of your 1964 Tempest, the reason might be absence of a foam rubber "cushion." The rattle could be centered in the area of the steering column opening cover. Don't let anyone screw this cover down—it's an access plate. Anyway, the cover's held firmly in place by a lower bezel. But there must also be two foam rubber pads beneath the upper cover assembly to eliminate rattles. If none are there, make your own.

★ If, suddenly, during the cold weather, the generator indicator light of your 1964 Corvair remains on after the car's been started, it's probably nothing to worry about. It might be only a slight misadjustment of the voltage regulator. To initiate a probable cure, take the regulator cover off and lower the cut-out relay closing voltage by turning the adjusting screw about ¼ turn in a counter-clockwise direction. Start the engine and check cut-out relay operation. When the engine's started and revved, the relay points should close and stay like that. When the engine's shut off, the points should open.

★ A growling or throbbing noise on 1963 and 1964 Studebakers coming from the engine compartment might lead to an idea that the water pump, alternator or torque converter is bad. Could be, but before going through an expensive repair, check that fan belt. The noise could be here, and Studebaker has issued new belts for these models because of this problem. For all cars and trucks without power steering, part number of the new belt is 1563072. For those with power steering, the number's 1563073.

As a service to Popular Mechanics readers with problems relating to their cars or to driving in general, we invite you to submit your questions for answering through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, N. Y. 10022, enclosing a stamped, self-addressed envelope.



KIT OF 12 CASTINGS MAKES THIS MODELMAKER'S METAL LATHE

By Howard Natter

IT TAKES A LATHE to make a lathe and that's why this little modelmaker has become a standard shop project, for teaching machine-shop students at Stuyvesant High School in New York City, the basics of metal turning. Each boy makes his own lathe, machining the castings as well as the rest of the parts on a classroom lathe, and from this one project he learns the fundamentals of lathe setups and practices, ending up with a lathe he can use.

For the man with a lathe it makes an interesting project which he can put to work in modelmaking. For the boy who is taking a machine-shop course at school, it makes an excellent class project. The set of twelve grey-iron castings are available from Honacast, 185 Grand View Blvd., Yonkers, N.Y. for $9.95 F.O.B.

Your very first step is to make a master drilling template from flat steel. This is used to spot the holes in the headstock, tailstock, ways support and carriage to assure they will be spaced identically in all four

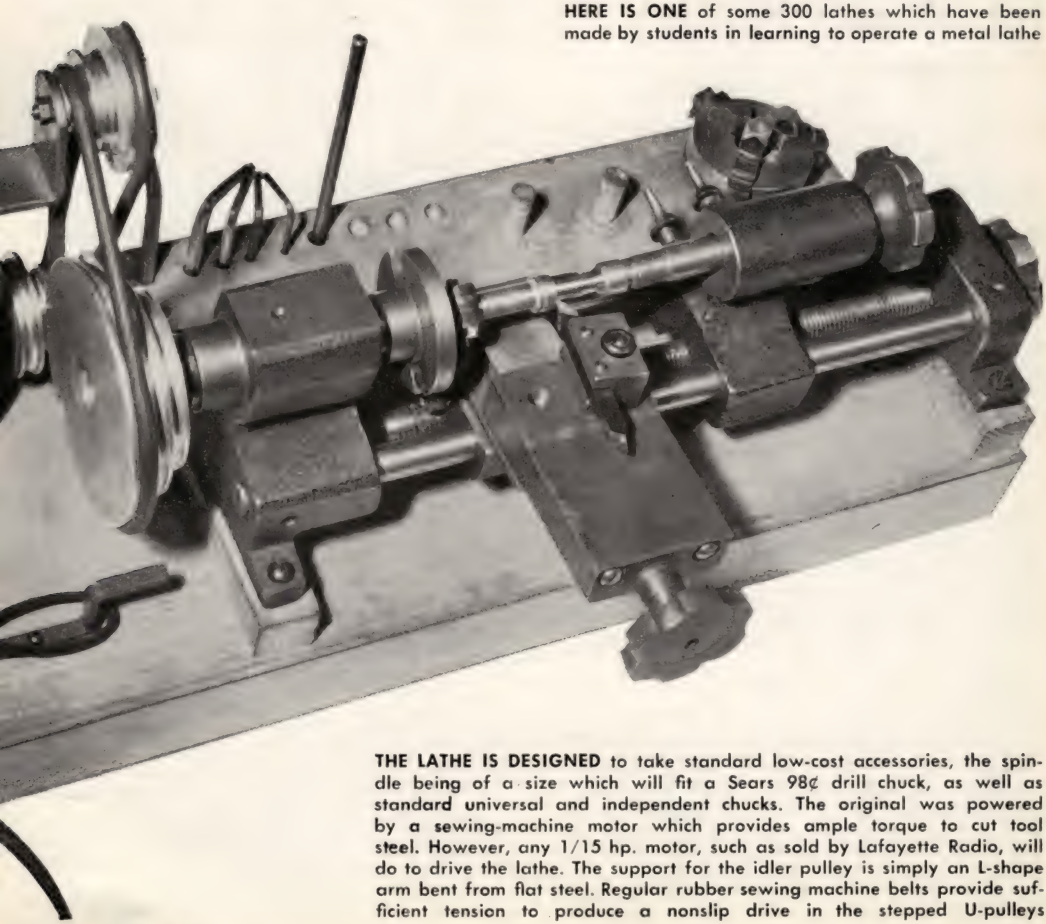
castings. A full-size pattern of the template is given on page 184. Here the dotted outline of the headstock merely serves to show the position of the holes in relation to the casting—your template need only be square.

Begin by marking the spindle hole on the rough headstock with a center punch, and mounting the casting in a 4-jaw chuck. Face off the end with two cuts, taking off the scale with one, following with a light 1/32-in. finish cut. Now with the casting still chucked, drill the spindle hole to 15/32 in., starting with a center drill, then switching in succession, to 1/4, 3/8, 7/16 and 15/32-in. bits. Finish up by reaming to 1/2 in.

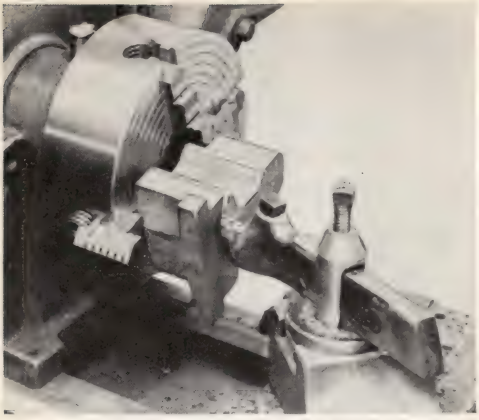
Turn the casting end for end in the 4-jaw chuck and use shims, or a piece of drill rod in the spindle hole, to chuck the casting squarely. Face off the rough end as before, cutting 1/32 in. below the scale.

Remove the casting from the chuck and use the template to locate one of the way holes. This is done by inserting a locating plug in the casting's spindle hole and placing the template over it. With the template

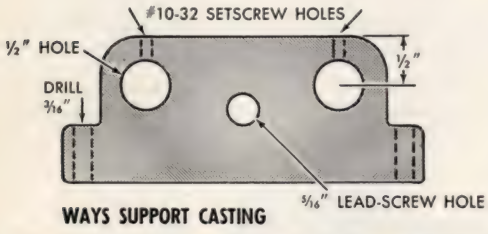
HERE IS ONE of some 300 lathes which have been made by students in learning to operate a metal lathe



THE LATHE IS DESIGNED to take standard low-cost accessories, the spindle being of a size which will fit a Sears 98¢ drill chuck, as well as standard universal and independent chucks. The original was powered by a sewing-machine motor which provides ample torque to cut tool steel. However, any 1/15 hp. motor, such as sold by Lafayette Radio, will do to drive the lathe. The support for the idler pulley is simply an L-shape arm bent from flat steel. Regular rubber sewing machine belts provide sufficient tension to produce a nonslip drive in the stepped U-pulleys



SCALE IS BEING REMOVED from face of rough headstock casting held in 4-jaw chuck. It's then turned end for end in chuck to face off opposite side. First bite should cut below scale to save cutting edge



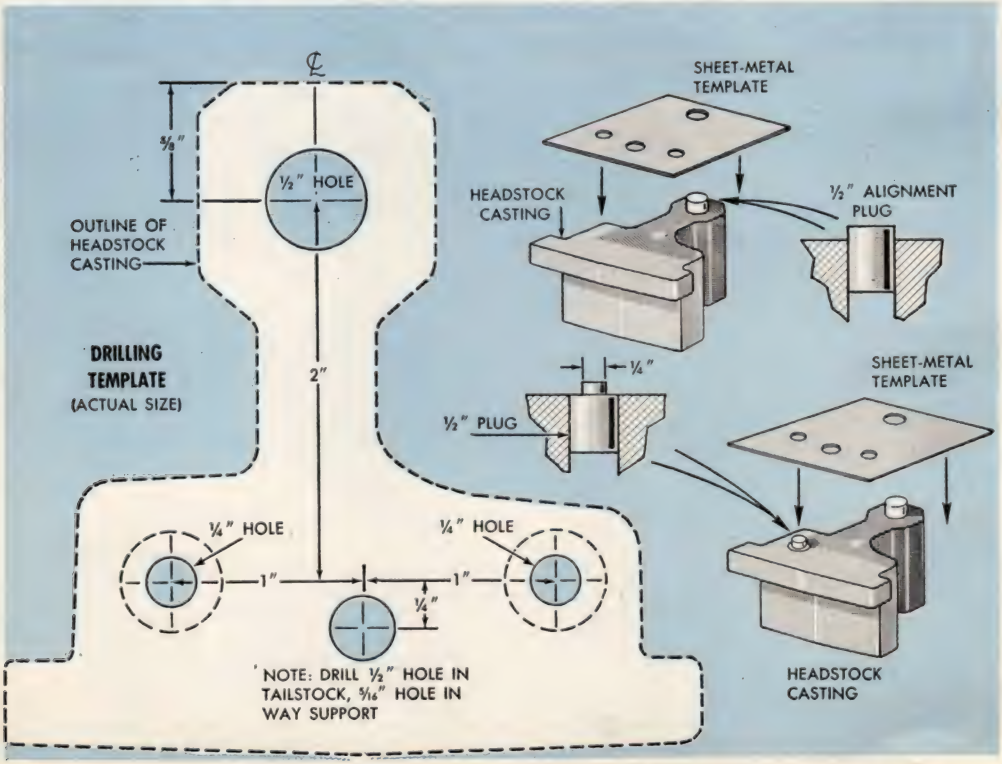
WAYS SUPPORT CASTING

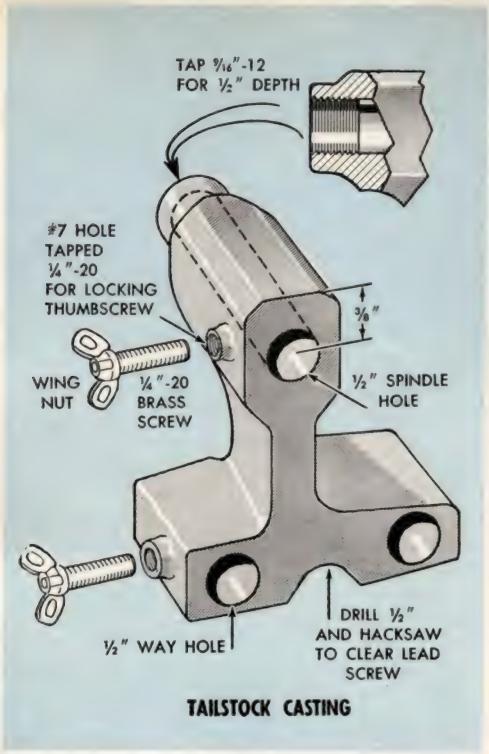
in position and the casting clamped to the drill-press table, drill a ¼-in. pilot hole all the way through. Then remove the template and enlarge the hole with progressively larger drills, finishing up with a ½-in. drill or reamer. Make sure this hole will be parallel with the spindle hole by first checking the squareness of the drill-press table.

To drill the second way hole, repeat the steps, using a shouldered locating plug in the first way hole to align the template. Finally, drill holes in from the side and top for 9/32 setscrews, and an oil hole down from the top. Set the headstock aside for the moment.

The initial headstock steps are repeated in machining the tailstock: Center-punch the spindle hole, chuck, face off the flat end of the casting and drill the ½-in. spindle hole. Turn the casting end for end in the chuck, being careful to see that the spindle hole is aligned perfectly, and thread the hole with a 9/16-12 tap for a depth of ½ in. Then face off the end of the casting. Next screw in the tailstock bushing tight against the shoulder, drill out to ⅜ in. and face off the bushing to ¼ in. from the shoulder.

To make this tailstock spindle bushing, mount hex stock in a 3-jaw chuck and turn to an O. D. of ¾ in. for a distance of ⅜ in. Turn a recess 1/32 in. deep and 3/32 in.





TAILSTOCK CASTING

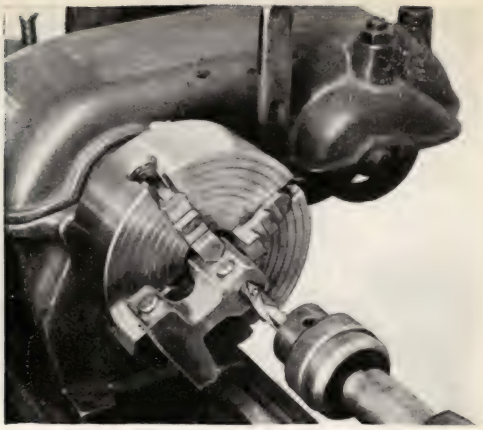
wide at the shoulder and run a 9/16-12 thread on the O. D. Finally, cut off the stock to make a bushing 11/16 in. long.

Remove the casting from the chuck and drill the way holes as before, first one and then the other. Here the drilling template is flipped over and the holes are drilled through from the rear side of it. As with the headstock, it is important to maintain the spindle hole parallel with the drill-press spindle.

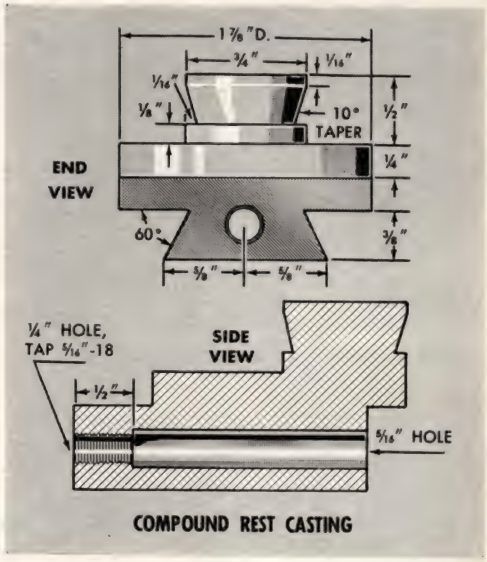
The leadscrew clearance hole on the underside of the casting is formed by locating with the template and drilling a ½-in. hole clear through after which the hole is cut V-shape with a hacksaw. The tailstock is completed by drilling #7 holes for locking setscrews and tapping ¼-20.

The rough support casting for the two ½ x 12-in. drill-rod ways is faced off on each side by mounting in a 4-jaw chuck and taking off the scale as before. Then with the work chucked so the jaws bear against the machined faces, the bottom of the casting is faced off. Now, using the drilling template once more, center punch and drill one way hole, following the steps already given, then drill the other. Now punch and drill the lead-screw hole, and complete the support by drilling and tapping the setscrew holes in the top, and drilling the holes in the shoulders.

Next comes the compound rest. First

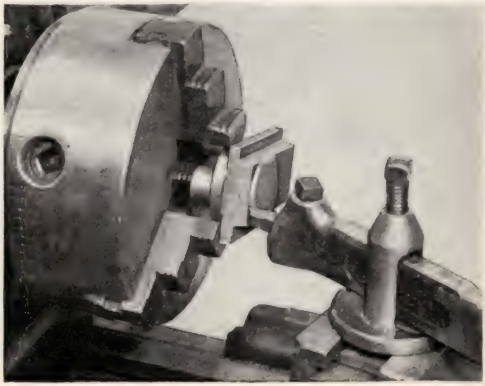


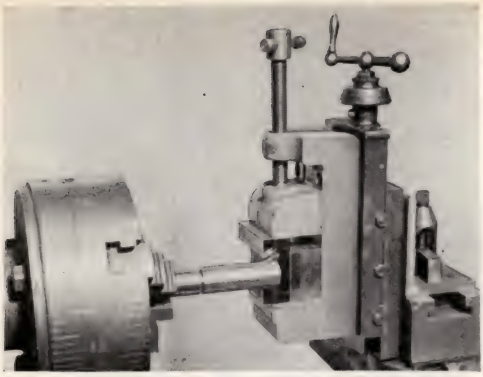
AFTER END OF TAILSTOCK casting is faced off smooth, spindle hole is center punched and bored with progressively larger drills chucked in lathe tailstock



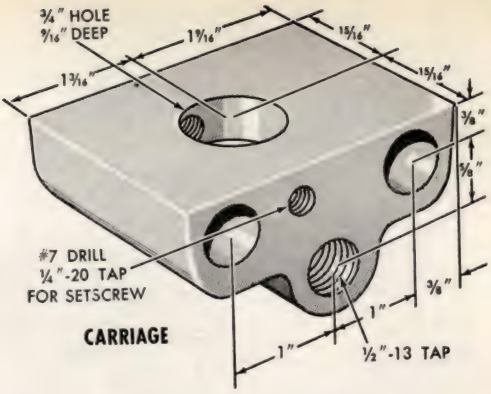
COMPOUND REST CASTING

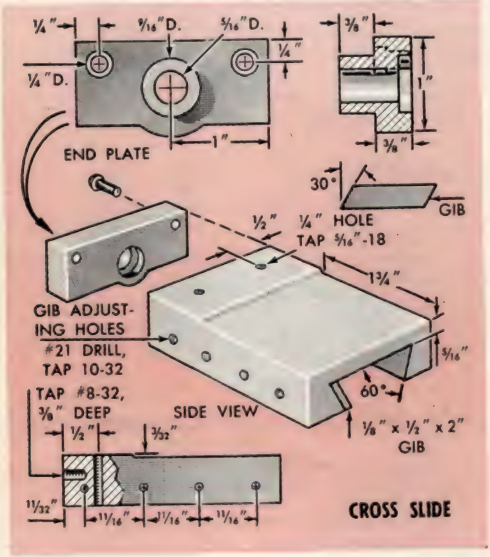
THREE-JAW CHUCK holds top of compound-rest casting for facing off the bottom. Work is then mounted in lathe milling attachment for dovetailing





HERE IS THE SETUP for forming the dovetail way in the cross slide by using flycutter mounted in chuck

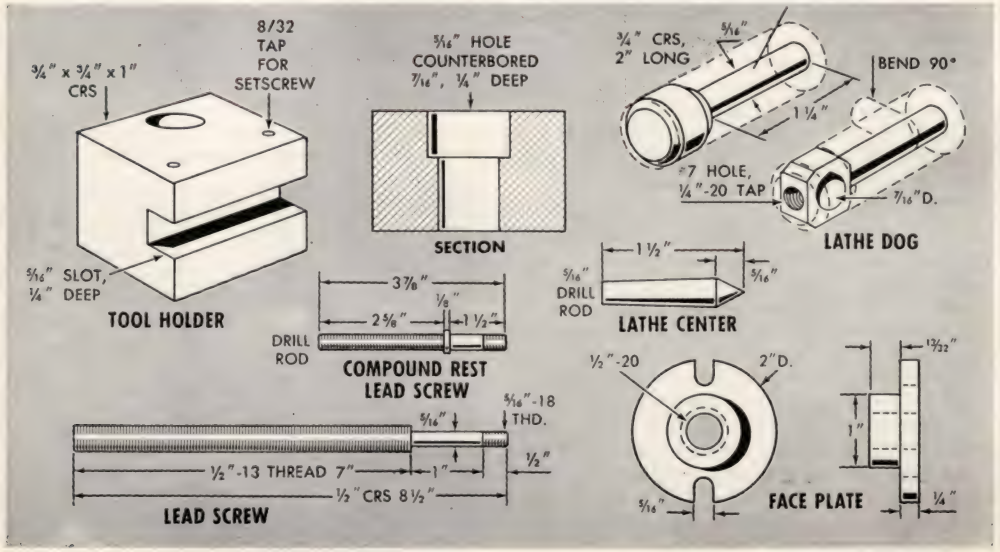


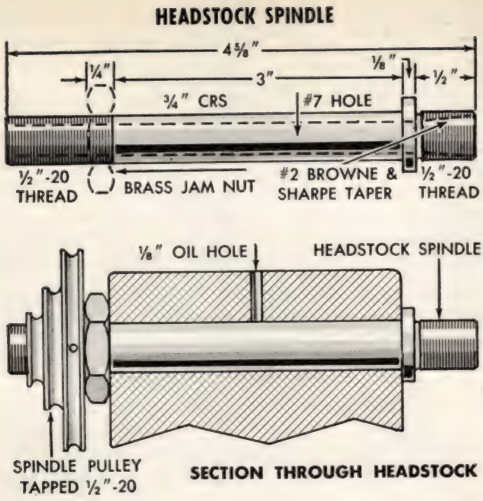


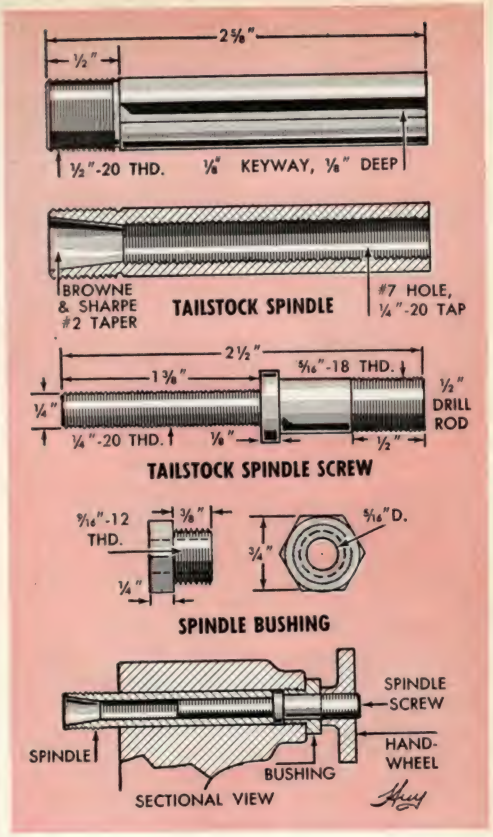
chuck the casting and face off the bottom, then turn it end for end and face off the top of the large diameter hub. Shift the casting in the chuck so the large hub is centered and turn it to a 1⅞-in. diameter. Next mark the center of the smaller swivel hub with a center punch and again shift the casting to center the mark and bring the shoulder parallel with the face of the 4-jaw chuck. With this done, turn the swivel hub to ¾ in. diameter, and machine the 1⅞-in. hub to a finished height of ¼ in., plus or minus .010 in. The swivel hub has a finished height of ½ in.

Cut a 10-degree taper on the hub for a depth of 5/16 in. This will leave a 1/16 x ⅛-in. shoulder at the base. Face off the other surfaces of the casting by clamping the chuck jaws against the machined surfaces. Finally, mount the work so the jaws grip the 1⅞-in. hub so you can machine the bottom to a final thickness of ½ in.

Now lay out and scribe dovetails on the square end of the casting and clamp it in







the vise of a milling attachment mounted on the lathe cross feed. With a boring bar chucked in the headstock and fitted with a tool bit that's ground to cut a 60-degree dovetail, run the lathe at low speed and cut one side of the dovetail. If possible, cut through the scale in one cut as this will keep the tool bit sharp longer. Use a fine feed, with the carriage locked, and tighten the gibs to limit backlash. If there is insufficient adjustment in the vise of the milling attachment to let you raise the work enough to cut the second dovetail side without disturbing the setup, you must take care, when you invert the casting in the vise, to maintain perfect alignment; the dovetail sides must be precisely parallel. Complete the compound rest by center-punching and drilling the hole for the cross-slide lead screw. Drill all the way through with a ¼-in drill first, then finish up with a 5/16 in. drill, stopping the drill ½ in. from the far end of the hole. The remaining portion of the initial ¼-in. hole is tapped 5/16-18.

All six faces of the cross slide are machined first. Then the mating dovetail for the compound rest is scribed on one end of the casting and cut as before with a flycutter. When this is done, remove the work and center-punch, drill and tap the four holes along one side for the gib adjusting screws. Next lay out, punch, drill and tap the ¼-in. holes for the tool holder. Set aside the cross slide and machine the end plate next. Mark the center of the hub and chuck the casting for turning the hub and shoulder to size. After this, switch to a 3-jaw chuck to hold the machined hub for facing off the back of the end plate, parallel to the front.

Drill a 5/16-in. hole concentric with the hub, using a ¼-in. drill first, and then counterbore it with a 9/16-in. drill for a depth of ⅛ in. After drilling the ¼-in. holes in the end plate, use the latter as a guide in drilling mating #7 holes in the cross slide itself. Note that the ¼-in. holes in the end plate are counterbored ⅛ in. for screw heads. Now with the end plate attached to the cross slide, mount the assembly in the lathe milling attachment and relieve the top of the casting 3/32 in. with an end mill or flycutter. The edges of the end plate are filed smooth.

Now for the carriage: First mark the location of the compound-rest bearing hole and chuck the casting in a 4-jaw chuck so the mark is centered. Face off the top surface 1/16 in. below the scale. Now with the casting still chucked, center drill and bore a ¾-in. hole 9/16 in. deep to mate with the swivel hub. It should be a tight sliding fit. Next face one end of the casting so it is square with the top surface, then turn it end for end and face off the opposite end so it is parallel with the first. Remove from the chuck and locate one way hole with the template. Drill as before, then form the second hole. Use locating plugs in the way holes, place the template over them and drill a ¼-in. pilot hole for the lead screw. Enlarge the pilot hole to 7/16 in.,

then thread it with a ½-13 tap. Finish up by drilling and tapping setscrew holes.

To make the 8½-in.-long lead screw, use a lathe dog and faceplate to mount the stock between centers. Thread the rod for 7 in. by chasing or using an adjustable die, well lubricated. Remove the work and reverse it between centers by using two ½-13 jam nuts on the threaded portion to serve as a drive and to protect the threads. Turn the remaining 1½ in. to a 5/16 in. O. D. and thread the end for ½ in. with a 5/16-18 thread for mounting a handwheel.

To turn the tailstock-spindle screw, center drill both ends of a 2½ in. length of ½-in drill rod. Mount between centers and turn to ¼ in. O. D. for 1⅜ in., then thread ¼-20. As was done with the lead screw, run nuts on the threads, turn the work end for end and turn the rest of the spindle screw to 5/16 in. O. D., leaving a ⅛-in. shoulder with an O. D. of ½ in. Thread the end for ½ in. to fit a 5/16-18 tapped hole in the handwheel.

Turning Headstock Spindle

The headstock spindle is made by center-drilling both ends of ¾-in. CRS or oil-hardening tool steel and mounting it between centers. Turn to ½ in. O. D. for 3 in. to fit the headstock spindle hole smoothly and without play. Thread the end for 1 in. with a ½-20 thread. Remove the work and run a brass hex nut against the shoulder of the thread until it locks, but not too tightly. Remount and face both sides of the nut to a ¼ in. thickness. The nut serves as a thrust washer and is used to take up spindle end play. Remove the work and run a second nut against the first, so the lathe dog won't mar the threads, and remount between centers, end for end. Turn down the end to ½ in. O. D. for ½ in., leaving a ⅛-in. shoulder. Cut a 1/32 in. recess adjacent to the shoulder as before and thread the end with a ½-20 thread. Now remove the nuts from the spindle and mount it in a 3-jaw chuck, protecting the threads with soft-metal shims. Drill a #7 hole all the way through the spindle, starting with a small drill. The Browne and Sharpe #2 taper is cut in the end of the spindle on the lathe itself, when assembly is complete. This assures accuracy and concentricity.

The tailstock spindle is made similarly from the same kind and size material. It should be noted that the length given for the spindle in the drawing is its finished length. However, to provide for mounting the spindle in the headstock for cutting the inside taper, it must measure at least 1-in. longer than its finished length so it can be threaded at both ends like the headstock spindle. As with the headstock spindle, the Browne and Sharpe #2 taper is left until later when it is cut by inserting the spindle in the headstock of the completed lathe. At that time, the opposite end is chamfered and the #7 hole is threaded with a ¼-20 tap until it meets the taper. The last step is to mount the spindle in the milling attachment, and with a ⅛ in. milling cutter, or a modified drill bit, cut a longitudinal groove ⅛ in. deep all the way to the shoulder. Note: If oil hardening steel is used for the head and tailstock spindles, harden it by tempering to a light straw color.

Compound-Rest Lead Screw

The compound-rest lead screw consists of a length of ½-in. drill rod, 3⅞ in. long. Center-drill both ends, mount between centers and turn to a 5/16-in. O. D. for 2⅝ in. Then thread 5/16-18, using a threading tool or a die and stock. Run two nuts on the threaded portion, reverse between centers and turn to 5/16 in. O. D., leaving a ⅛-in. shoulder. Complete by threading the end 5/16-18 for a distance of ½ in.

The two lathe centers are turned from lengths of 5/16-in. drill rod chucked in a 3-jaw chuck. Set the lathe compound rest to cut a 1/12-degree taper (½ in. per ft.) and machine taper the rod for 1 in. from a point 5/16 in. from the end. Cut off at the taper's end and turn the points later.

A 1-in. length of ¾-in.-square steel is needed to make the tool holder. Face off the ends in a 4-jaw chuck; then with the work mounted in a milling attachment, mill a slot 5/16 in. wide and ¼ in. deep with a ¼-in milling cutter. Lay out, punch, drill and tap for 8/32 setscrews, and finish up by drilling the 5/16 in. tool holder locking-screw hole, counterboring it with a 7/16 in. drill for a depth of ¼ in.

Three Handwheels Required

All handwheel castings are machined alike in a 3-jaw chuck. Turn the hubs to 9/16 in., and face the ends and shoulders. Center-drill and bore a ¼-in. hole in each, tap 5/16-18 clear through. Reverse the work in the chuck to machine the outer diameters and face. Finally, drill and tap for 8/32 setscrews. In the case of the lead-screw handwheel particularly, you can add a crank-type handle to it to make it easier to turn on long cuts.

The round-belt grooves in the three-step spindle pulley are cut with a round-nose tool having a ⅛-in.-radius. First chuck the casting in a 3-jaw chuck and face the end. Follow by center-drilling and boring with a 7/16-in drill, then thread with a ½-20 tap. Now mount the work on a threaded arbor (a bolt will do) and turn

(Please turn to page 212)

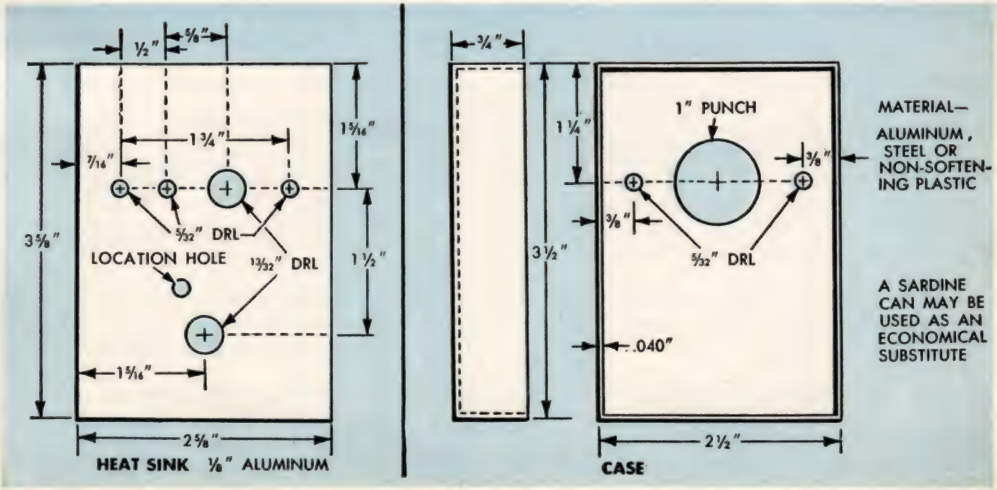
PLUG-IN POWER CONTROL

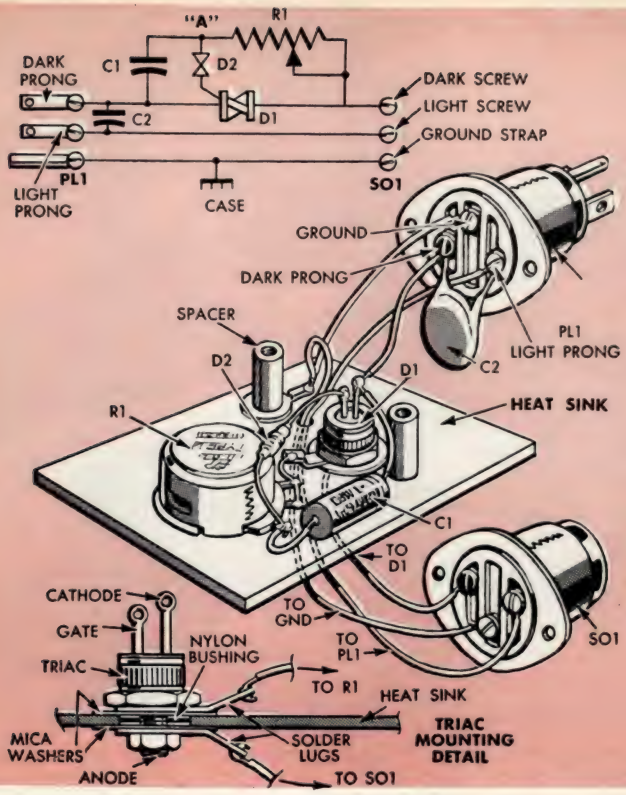
It turns any outlet into a dial speed control for your drill, a heat control for your soldering gun, or a dimmer for any lamp or photoflood. And you can make it for around $10

By Don Lancaster

THE BIG TREND in portable power tools is built-in speed control. There's a decided advantage in being able to suit the speed of your drill or saber saw to the job at hand, and many owners of one-speed tools have looked into control boxes that would convert their tools to multi-speed use. But commercial models often involve wall mounting or a cumbersome box—and they can run fairly high in cost.

Behold, then, this compact, inexpensive unit you can make yourself. It plugs directly into any wall outlet, which means that when you're not using it in the shop to slow down your drill or sander you can take it anywhere in the house to serve as a light dimmer, a temperature control for electric heaters—or as a speed control for kitchen appliances! It's rated at a full 600 watts of control power and provides a smooth, continuous range from "off" to "on"" with a single turn of its knob. The only place it *won't* work are with fluorescent lamps, induction or synchronous motors, or on current other than 110-volt, 50 or 60 cycle a.c. *(Turn page for details)*





ELECTRICAL PARTS

R1 250 K POTENTIOMETER, CARBON, LINEAR TAPER

C1 0.1MFD/200VOLT TUBULAR CAPACITOR

C2 0.02 MFD/500 VOLT DISC CAPACITOR

D1 ZJ-257 TRIAC (GE)

D2 ER-900 TRIGGER DIODE (TRANSITRON)

PL1 3-PRONG SNAP-IN PLUG (AMPHENOL 160-10)

SO1 3-PRONG SNAP-IN SOCKET (AMPHENOL 160-11)

SHELL, RECESSED ADAPTOR (AMPHENOL 61-61)—NEED 2

TRIAC MOUNTING KIT, SILICON GREASE, WIRE, SOLDER, SPAGHETTI

¼" ID GND LUG, #6 SOLDER LUGS

MECHANICAL PARTS

CASE, ZERO MFG.CO., MONSON, MASS. #Z-40-56B-12, OR SARDINE CAN

HEAT SINK, ⅛ x 2⅝ x 3⅝"

SPACER, ¼" x ¾" ROD TAPPED 6-32-NEED 2

SCREW, 6-32 x ⅜", BINDER HEAD-NEED 4

WASHER, #6 SHAKEPROOF-NEED 4

KNOB, ¼"-DIA. SHAFT, ⅞" OD

The key to the gadget's simplicity is a new semiconductor device called *Triac*; it's the equivalent of two silicon controlled rectifiers (SCR's) back-to-back in the same can.

There are two ways to control the power reaching any motor, lamp or heating coil. You can *vary* the voltage (as with a rheostat or volume control) . . . or you can let *full* voltage reach the load in on-off cycles. By varying the ratio of "on" time to "off" time, you can control the load power. When this is done fast enough—say 120 times a second—the power flow is smoothed out by the inertia of a motor or light-bulb filament. This method produces much less heat than the first one.

The Triac is nothing more than an electronic switch. Pulse its gate and it turns on; let the voltage across it drop to zero and it turns off. The Triac, unlike SCR's, works in either current direction, and thus makes no distinction between positive and negative cycle halves. This eliminates the diodes and fancy switches commonly used in the bigger SCR controls.

You achieve a *range* of power by controlling the *point* in each half-cycle the Triac is pulsed on. If it's late in the cycle, very little of the available power gets through, and the motor runs slowly or the lamp is dim. If the Triac turns on in the middle of each half-cycle, about half the power gets to the load.

A pulse circuit consisting of a variable resistor (potentiometer—R1 in the sketch above), capacitor (C1), and a special avalanche diode (D2), decides when in each half-cycle the Triac (D1) will fire. The diode is rather like a neon lamp; it's off until the voltage across its terminals reaches plus or minus 30 volts, at which point it snaps on for as long as there's any current left in the circuit, feeding this current to the Triac gate. (If you have trouble locating a Transitron diode, you can substitute a GE Diac ZJ-238, or Texas Instruments' TI-43.) The second, smaller capacitor (C2) is needed to keep the fast turn-on of the Triac from radiating back through power lines as radio noise.

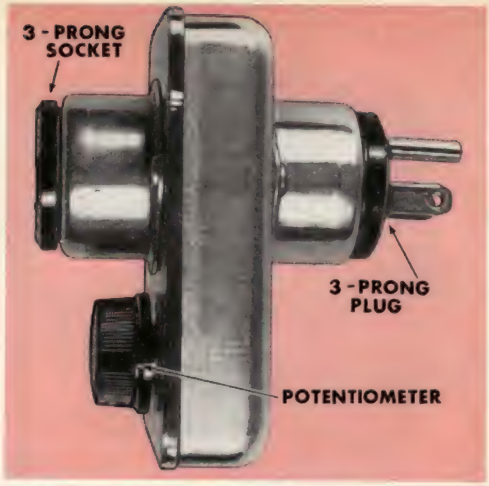
The deep-drawn aluminum box shown in the photos, and listed under "Mechanical Parts," is rather expensive. If you prefer, you can bend up a box from sheet metal—or even use a sardine can. The three-prong plug is used for power-tool safety, and to provide extra support for the plugged-in box. But if you do not have this type of outlet in your home, you can either use an inexpensive adapter between the box and the outlet, or substitute a

standard two-prong plug in the assembly. If you choose the latter, bear in mind that you are providing no ground for tools unless you retain the three-prong socket and use a grounded adapter on the end of the line cord. With the new shock-proof tools, no such precaution is necessary.

When drilling the heat sink, note that the smaller of the two potentiometer holes is for the anti-rotation key; its location will vary for different brands. You can substitute copper for the heat sink, as long as it's at least ⅛ in. thick—but not steel or other material. If you're using a sardine can for the box, make the sink slightly larger than the can.

Shorten the stud on the Triac ⅛ in. before mounting it with an insulated mounting kit. Use silicone grease on all mounting parts to insure low thermal resistance. Add a second large solder lug to the one provided in the kit, giving a lug on both sides of the sink. Double-check the mounting—with an ohmmeter, if you have one—to make sure there's no electrical connection between Triac and sink.

Use spaghetti on all leads, and avoid excessive heat when soldering to the Triac or the diode. Watch the clearance between shells, socket, plug and Triac. If you're careful, everything should fit with safe clearances between terminals. You might want to add a bit of insulation (fish paper, varnished cambric, fiberglass) between Triac and socket. No. 16 stranded wire is best for all leads. The ground wires are connected to the heat sink by means of a solder lug under one of the spacers. The disc capacitor (C2) is added to the plug when the leads are soldered on.

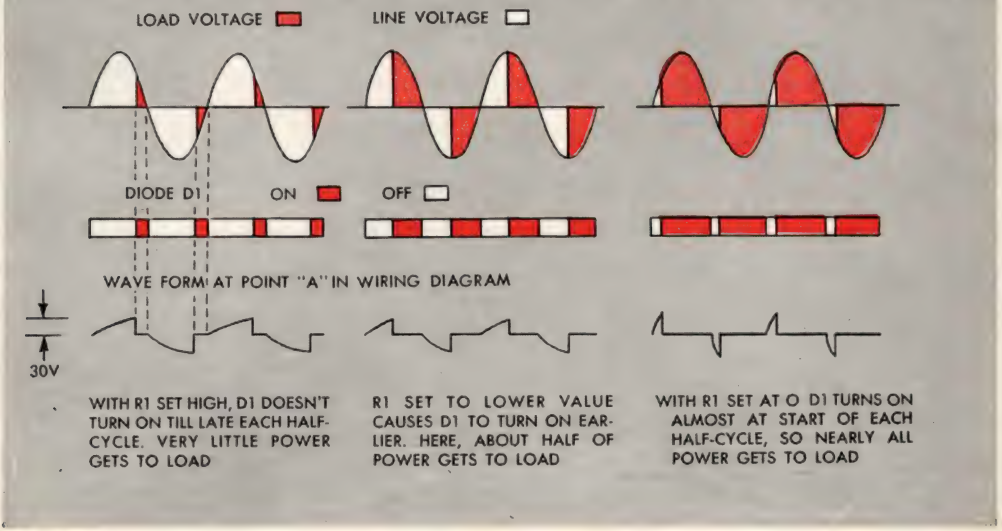


ASSEMBLED UNIT for a three-way wall outlet has an extra ground prong (right) for grounded wall outlet

When assembly is complete, test the operation with a 25-watt bulb. (Since the *minimum* load this control will operate is around 10 watts, a neon test light won't do.) The dial should smoothly control the brightness. A small jump from completely off to just-barely-on is normal, followed by smooth control from a pale orange glow to full brightness. Under a full 5-amp, 600-watt load, the heat sink will get hot, but this, too, is normal.

Your cost will range from about $8 to $12 depending on whether you've a well-filled parts-scrap-box, or must start from scratch. The cheapest comparable unit you could buy would run around $18—and it won't have the plug-in feature. ★★★

HOW TRIAC CONTROLS THE ELECTRICAL FLOW


LOAD VOLTAGE
LINE VOLTAGE
DIODE D1
ON
OFF
WAVE FORM AT POINT "A" IN WIRING DIAGRAM
30V
WITH R1 SET HIGH, D1 DOESN'T TURN ON TILL LATE EACH HALF-CYCLE. VERY LITTLE POWER GETS TO LOAD
R1 SET TO LOWER VALUE CAUSES D1 TO TURN ON EARLIER. HERE, ABOUT HALF OF POWER GETS TO LOAD
WITH R1 SET AT O D1 TURNS ON ALMOST AT START OF EACH HALF-CYCLE, SO NEARLY ALL POWER GETS TO LOAD

PRIME SOURCE of ozone aroma is at the picture tube high-voltage connector. Wipe the tube glass clean and spray carefully with anti-corona dope

HOW TO

Smell Your TV Troubles

The smell of rotten eggs, ozone, burning rubber or hot wax are clues to specific TV ailments. Here's what they can mean

By Art Margolis

IF AND WHEN your TV starts acting up and gives off an odor, it becomes rather easy to smell down the source of trouble. Your sniffing sense becomes a valuable piece of test equipment to help you detect the bad component.

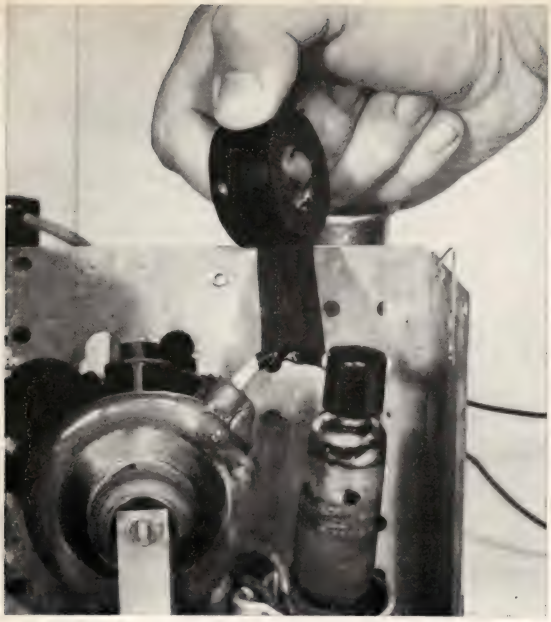
There are only a few parts of electronic gear that can burn. Each gives off its own distinctive aroma. They are resistors, transformers, coils and rectifiers. Let's go through the various scents and note the servicing moves that are indicated.

Resistors a la Fricassee

From an electrical point of view, a dressed chicken ready for the oven is a fat juicy resistor with a value of about 100,000 ohms. Current can cook this chicken to a turn.

Resistors must be cooked, they do not burn of their own accord. While excessive current is being pumped through them they produce acrid smoke and a distinct aroma of carbon, wire, insulation and paint. As soon as the current is turned off the fire, smoke and smell stops. Never just replace a burnt resistor. You must find out why it burned or the new one will go up in smoke too.

When your TV starts acting up and gives off a white smoke that can be suffocating but almost odorless it's a resistor burning.



A COUPLE OF TURNS of plastic electrical tape around an old high-voltage wire will stop arcing without requiring replacement of the worn length of wire

HERE'S A PAIR of selenium rectifiers that smell like rotten eggs when shorted. If only one is bad, it's still best to replace both at the same time

Turn off and disconnect the set. Then determine the approximate area of the chassis that the smoke originated from. Now start a close examination under good light looking for some charred remains.

Slight charring blackens the resistor and ruins the gaily painted colors that designate its value. Extensive burning blackens the area around the resistor and can even cause the resistor to break in half, leaving two stubs. Once you find a burnt one, look around it and follow up the attached wiring. You may find a second and even a third in the same circuit.

Once located, you have to determine whether the resistor is burning because it is defective or because some other nearby component has given up the ghost.

This is done by elimination. Check the junctions where the two ends of the charred resistor are attached. There will be other parts also attached. Follow the wires and see if any of them lead to a tube socket. Then pull out any such indicated tube and turn the set on again. If the burning has stopped, the tube is bad. If the smoke continues the tube is good.

Now trace out any capacitors that are in the line. Disconnect one end of any suspect and turn the TV on again. No more smoke indicates the capacitor is bad. Replace the bad tube or capacitor and the burnt resistor. In the majority of cases the set will work now.

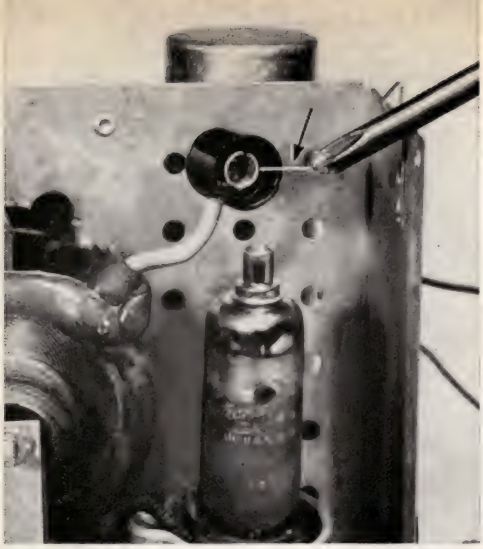
If it doesn't, the trouble is in the minority realm of tricky jobs and further troubleshooting requires more than smell or sight to solve. This is the point where you should decide to call for more skilled help.

Toasted Transformers

When a transformer begins incinerating, it gives off a white smoke and a distinctive odor of burning rubber, insulation and molten wax. Sometimes there is a crackling, frying sound. Once you get the smoke signal, turning off the set will not put a complete stop to it. The smoke, smell, and sound will persist for a while.

Locating the bad transformer requires the use of your hands and eyes. First see if you can spot the source of the smoke. In a TV it could be the power transformer, audio output transformer, vertical sweep transformer or perhaps the yoke. Once you think you know which one it is, touch it tenderly with your hand and feel for heat. A bad transformer will be too hot to hold immediately after you turn off the power. All transformers run a little warm, but should never be too hot to touch.

Once you have discovered the culprit the next step is replacement. As a safety measure always replace the tubes associ-



OZONE ODOR is generated when high voltage sparks across an air space. Here we intentionally draw an arc from high-voltage tube anode to ground

ated with the transformer too. If it's a power transformer, replace the low-voltage rectifier. If it's an audio output transformer, replace the audio output tube.

In the rare event that the new replacement also starts to overheat, smell alone won't effect the cure, and more skilled techniques are going to be required. Fortunately this won't happen very often.

When High Voltage Fries

The characteristic smell of high-voltage burning is a distinct ozone odor like the smell after a lightning storm. It tells you to look for trouble in the high-voltage section of the set.

If you smell ozone, darken the room and visually examine the high-voltage area with the TV on, looking for the fireworks. The ozone producer will appear as arcing accompanied by punctuated snaps or corona heard as sizzling and giving off a bluish ray.

Mild corona is usually just an insulation problem. Aging insulation permits the 20,000 volts to leak out into the air. If the origin is a wire, take some high-voltage plastic tape and reinsulate the area.

If the coil or transformer is the trouble spot, use high-voltage dope or anti-corona spray to coat the bad spot. Apply several layers, allowing each coat to dry completely before applying the next one.

Arcing is different and usually occurs in either the filament wires to the high-voltage rectifier or the high-voltage lead to the picture tube. An effective repair requires replacing the defective wire. Make sure you use high-voltage cable specifically designed for this job. It can be obtained from most electronic supply houses. If this wire is not available locally order from one of the mail-order electronics firms.

If you do any soldering in the high-voltage section, be sure that all points are rounded. A pointed joint discharges high voltage easier than a rounded one.

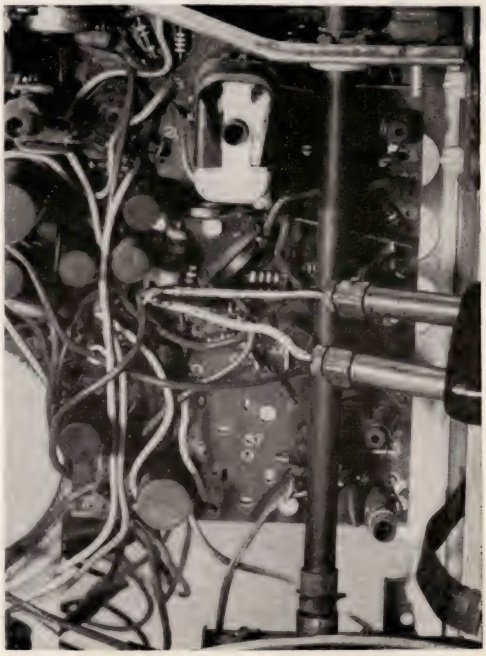
Any other high-voltage problem is not one to be handled by the amateur and should be referred to a skilled service technician.

Rectifier Stench

Should your TV suddenly give off the aroma of rotten eggs, you have a clear cut repair in most cases. This odor appears when selenium rectifiers go bad. In a TV it is accompanied by loss of picture and sound although the tubes stay lit. Sometimes the set will continue playing or the picture might shrink in on the sides. At any rate, replacement of the rectifiers will put a stop to the odor and the symptoms.

The repair techniques discussed in this article often require working with the TV chassis out of the cabinet. When working this way be careful. Do not bang against or scratch the picture tube. Be sure the set is turned off and the line cord unplugged from the wall before poking around under the chassis with your fingers. And most of all, keep all children away from the work area and if possible out of the room. ★★★

SOLDERING GUN makes rapid parts replacement. Before doing any soldering, however, be sure that the set has been disconnected at the a.c. wall outlet



Big Bass From a Small Speaker

Good hi-fi sound comes from 5-inch speakers. Build the cabinet in a few hours, and use the system in any room of the house

By Tony Doschek

AMD SA-50 5-inch speaker is the secret of getting good low-frequencies from a small enclosure. It has a maximum cone excursion of 0.31 inch

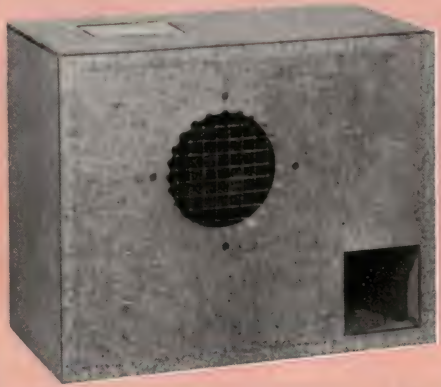
FOR REPRODUCED MUSIC to sound good, it must be rich in the low frequencies. To reproduce low frequencies normally requires a large speaker in a large enclosure. We've made a switch. Here are two small enclosures, each one requiring a single five-inch speaker that goes below 50 cycles.

The main secret is in the speaker. It is an AMD Electronics Model 5A-50. It is 5 inches in diameter, has a 16-ohm impedance, music power capacity of 8 watts, a 2-inch diameter voice coil and a 45,000 Maxwell magnetic field. In a small cabinet results are amazing.

Take the infinite baffle shown on the next page. Despite its tiny dimensions (it measures only 15¼ by 8½ by 9¼ inches) it produces a smooth output of all frequencies from 80 to 16,000 cycles.

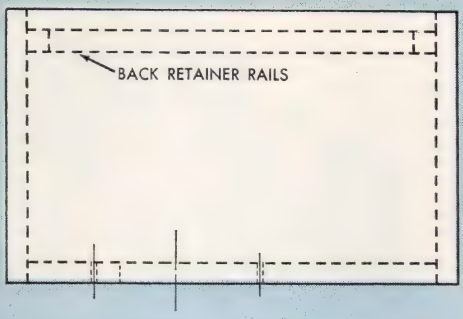
If more bass is required, try the vented enclosure also detailed on the next page. Its frequency range starts below 50 and goes above 16,000 cycles. Either one of the compact pair can be used almost anywhere.

(Full construction details on following page)

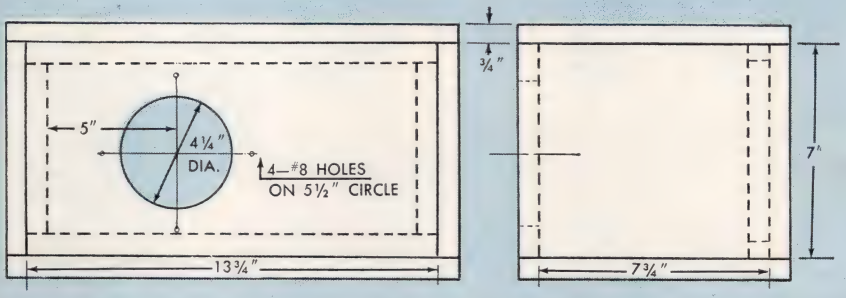


FINISHED ENCLOSURES: Vented unit is on the left, infinite baffle is below. Grille cloth, a coat of paint and some trim are finishing touches

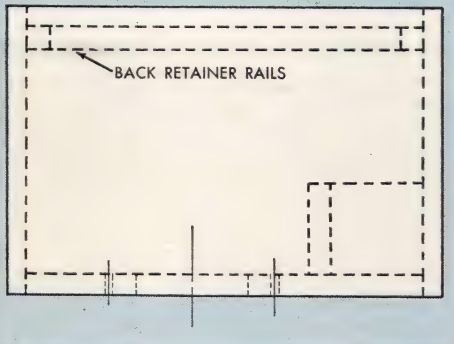
INFINITE BAFFLE ENCLOSURE **15¼ x 8½ x 9¼ INCHES OVERALL**



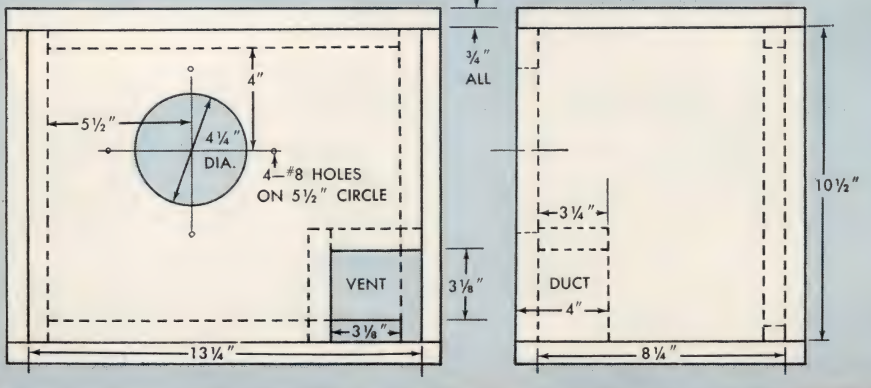
1. MAKE FROM ¾" PARTICLE BOARD OR PLYWOOD.
2. LINE ENTIRE INSIDE WITH #1 OR #2 DENSITY, 1" GLASS FIBER STAPLED LOOSELY IN PLACE.
3. CHAMFER SPEAKER EXHAUST HOLE OR FLUTE FOR IMPROVED MIDDLE AND HIGH FREQUENCY DISPERSION AND AVOIDANCE OF STANDING WAVES.
4. PROVIDE #8 VENT HOLE, ANYWHERE FREE TO OUTSIDE TO COMPENSATE FOR BAROMETRIC CHANGES.
5. PROVIDE TERMINAL BOARD ON REAR FOR SPEAKER LEADS.



VENTED ENCLOSURE **14¾ x 12 x 9¾ INCHES OVERALL**



1. MAKE FROM ¾" PARTICLE BOARD OR PLYWOOD.
2. LINE INTERIOR OF BACK, TOP AND SIDE OPPOSITE DUCT WITH #1 OR #2 DENSITY, 1" GLASS FIBER. STAPLE LOOSELY IN PLACE.
3. CHAMFER EXHAUST HOLE, OR FLUTE, FOR IMPROVED MIDDLE AND HIGH-FREQUENCY DISPERSION AND AVOIDANCE OF STANDING WAVES.
4. PROVIDE TERMINAL BOARD ON REAR FOR SPEAKER LEADS.
5. BACK LOAD SPEAKER WITH 8" SQUARE OF NEOPRENE BACKED #1 DENSITY GLASS FIBER WITH 3" DIAMETER PERFORATION FOR MAGNET COVER. APPLY WITH GLASS FIBER SIDE TOWARD SPEAKER AND STAPLE AT EACH OF FOUR CORNERS ONLY.



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Kelly's Awful Airline

(Continued from page 125)

danger that had been passed. The crew and its passengers were now stranded on a plateau of ice 8680 feet thick. They had to survive in an area of the world where temperatures average –18° F. but can dip to –82° F., where the land would provide nothing for survival but snow that could be melted to water.

As soon as it could, a Search-and-Rescue crew took off from McMurdo in a jato-equipped C-47. By the time it reached the downed C-130 it was greeted by a large sign stomped in the snow proclaiming the site "Darbyville."

Panic to Picnic

After they landed, the rescue team expected to be greeted by half-frozen, starving icemen. Instead, they were calmly ushered toward a row of red tents and white snow huts. Inside one of the huts was a delicious smell—stew being cooked on portable stoves, with the smoke carried out by a flue of empty oil cans.

Major Darbyshire and his men had set up a city. He had turned near-tragedy into a survival exercise. He had averted disaster by proving that, with coolness in the face of all that coldness, being downed in the Antarctic could be converted from panic to picnic.

Mechanics from the rescue plane looked over the C-130 for the cause of the engine failures. Their examination pointed to ice contaminating the fuel system.

Four days later, the C-130's engines were alive with power and it was skimming over the ice, rising into the air, and homeward bound.

But there are other dangers on these bottom-of-the-world flights. One is the whiteout—when the horizon and all shadows disappear as cloud cover and white landscape merge into one.

During northern summers, at their Quonset Point, R.I., home base, VX-6 crews practice the whiteout landing procedure. The pilot simply lowers skis and flaps, reduces power and sets up a standard landing glide. Outside all is milky; inside are the instruments, which become his senses. The pilot relies on only one of his own, the feel of the skis touching and the shudder they impart to the plane.

Like any emergency procedure, however, it is never practiced enough. Caught in a real Antarctic whiteout, a pilot felt his C-47 workhorse shudder, so he cut back his engines. But the shudder was due to the plane's stalling—not a few feet off the ice, but at 300 feet. The plane pancaked severely onto the ice. The crew walked away, but left a total wreck behind.

Another C-47 pilot landed more properly in a whiteout, then waited for his air-speed indicator to drop to zero. This would indicate that his plane had completely stopped. After several minutes, however, air speed was still 30 knots.

The pilot asked his crew chief to open the back door and step down to see if he could feel anything solid below them. The chief did, and stepped out. He almost disappeared in five feet of snow on which the plane was resting. It was stopped all right, but headed into a 30-knot wind.

Winter in Antarctica, contrariwise, is a blackout of perpetual night. It has been pierced by a plane only once. A Seabee at McMurdo had fallen and broken his back. He was paralyzed and in need of complete medical treatment. In an 11,000-mile radiotelephone call, McMurdo's doctor, Lt. Thomas Bates, asked Rear Adm. James R. Reedy at the Pentagon for help.

The admiral, who commands all naval support forces on the White Continent, relayed the plea to VX-6. Almost immediately, two C-130s were on their way with a Navy doctor and special surgical equipment. On landing at Christchurch, the pilots scrambled for the operations office to check McMurdo's weather. It couldn't have been worse—a blowing, whistling blizzard with no visibility.

After the planes were refueled, McMurdo weather was checked again. Visibility had lifted to 10 miles. One of the propjets, flown by Lt. Robert V. Mayer, 40, was soon airborne. On board was just enough fuel to come back, should weather close in again.

Lit Up Like Christmas

Luckily, it didn't. "The station was lit up like a Christmas tree," Mayer reported. Oil drums and flares had been set up alongside the ice runway to pierce the blackout and help the *Hercules* home in.

Wind is always devilish in Antarctica. On one helicopter flight to Cape Crozier, a short hop across Ross Island, the winds at McMurdo station at one end of the island were but 15 m.p.h. But at the Cape, they were an unexpected and howling 100 m.p.h. The slow-flying helicopter was blown past the landing pad and out over the frozen sea. Only with maximum power on the helo's engine, and after eight minutes, was it able to inch back to Crozier.

Both the helicopters and the C-47s, plus a few one-engined *Otters*, do the special short-haul jobs, like taking scientists and their instruments and equipment out to remote glaciers, mountains and stations. They're perfect for hauling small loads

(Please turn to page 203)

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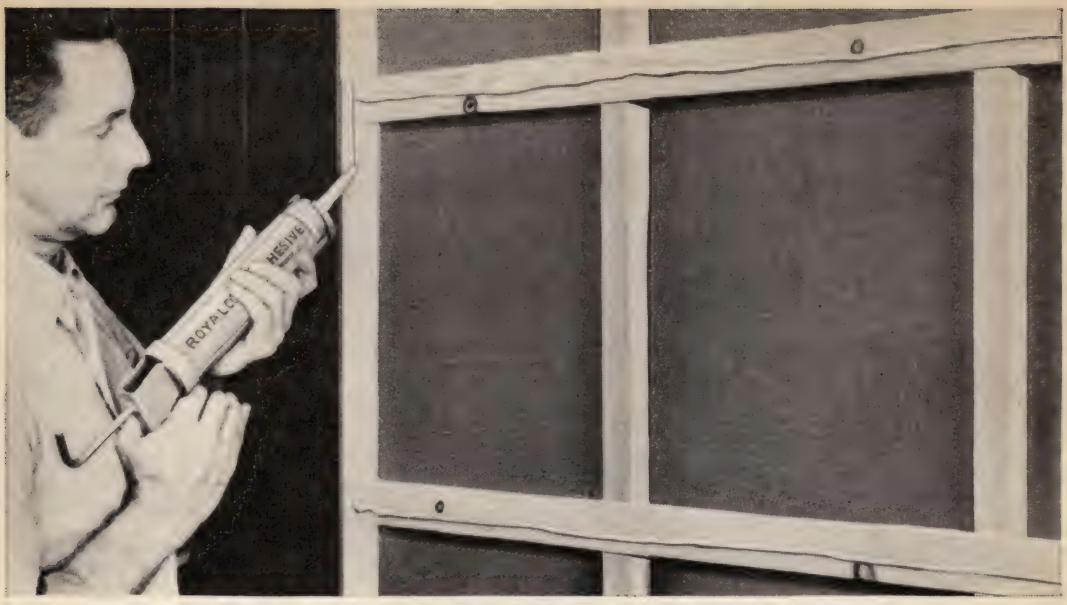

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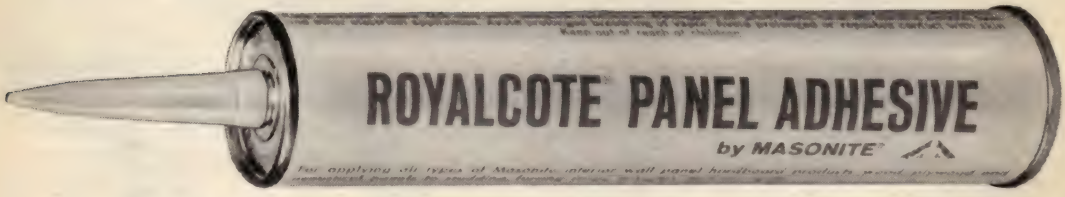

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Kelly's Awful Airline

(Continued from page 200)

relatively short distances. And they are versatile. The helos, too, are veritable mechanical acrobats. And that's fine for serving the scientists who sometimes have the weirdest ideas.

Take the hair-raising "routine" flight of 30-year-old Lt. James Brandau.

"The other day," blonde-bearded Jim told me, "New Zealanders wanted to put a surveyor's landmark on top of a mountain." He loaded them and their equipment aboard his whirlybird and flew them out to the 2700-foot peak.

"The marker—which was really just three oil drums bolted together—had to be right on the point and there was no place to land. I sidled the aircraft slowly over to the peak until the right front gear touched. Then I hovered there, with the left front gear and the rear wheel hanging in the air."

Hovering requires the engine to be at 80 percent power, so the scientists had to be quick. The helicopter's side door was opened, and they stepped out onto the steep icy peak. They pulled out the steel drums, secured them to the mountain top, and climbed back in. Then the helicopter was off again.

Seals Picked Up

Specialty flying is the helicopter pilot's dish. Early this season, for instance, they literally picked up six Weddell seals from the sea ice and carried them 10 miles back to McMurdo.

Not all flights are rosy. One helicopter flying a field party out of a deep desolate valley carved between sheer cliffs had an engine failure. Lt. G. L. Maaske told me how he set the craft down on Ferrar Glacier 60 miles from McMurdo. He and the two scientists pitched a survival camp and cooked mulligan stew. In six hours an *Otter* plane circled overhead, dropped crackers and jam, cigars and a magazine.

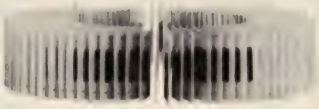
Then they were picked up and a six-man maintenance party, tools, food, and a replacement engine were left behind. The mechanics worked and slept in the open four days before the helicopter was fixed.

For big loads and long distances, the C-130 is the Kelly Airlines' workhorse. Unlike the older P2V and the C-47, it can take off from unprepared ice without help; jato is rarely used, and only for extra-heavy loads. Supplies are landed now; parachute drops are obsolete.

The C-130 engines, being jets, require no prewarming. The plane carries its own auxiliary power supply for engine starts,

(Please turn to page 204)

Kodak



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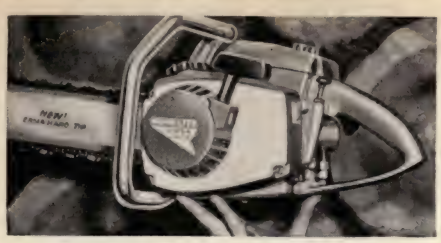

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Kelly's Awful Airline

(Continued from page 203)

in the form of a small jet engine mounted hidden inside the left landing gear well.

That's what Commander Kelly and the other pilots mean when they say the *Hercules* has revolutionized Antarctic flying. And the tale of Darbyville proved, as one crew member said, "that we have a 5000-mile runway here."

Even with these wonder planes, though, the problem of getting around is a formidable one. There is no network of radio-navigation stations for constant bearing checks. In fact, there are few fixed things upon which to check your position.

Further, the magnetic compass goes crazy and is unreliable near the Pole.

The navigators who fly the regular routes use everything they can. They use celestial navigation, but because there is 24-hour daylight they can use only one star, the sun. Each plane has a radar set and its navigator relies heavily on check points he can pick up for a fix of his position or for determining his ground speed and drift. Established mountain ranges and peaks are reliable; so, too, are giant crevasse fields which have characteristic shapes on radar.

Abandoned crashed planes that poke above the snow drifts are also excellent landmarks, especially for radar because metal reflects these waves best. That's one way newly downed planes are located, too.

Abominable Snow Snake

But there always are unexplained exceptions. Like last November when a C-47 on the way back from Byrd Station began losing oil from one engine—and altitude. After dumping 350 gallons of fuel and 400 pounds of fresh eggs—that left a half-mile yellow streak on the ice—the plane made an emergency landing. A companion C-47 landed beside it, picked up the crew and continued on to McMurdo.

The next day a plane loaded with mechanics flew out to where the downed plane should have been. But they couldn't find it. On their return they reported, scratching their heads, that "apparently white desert Arabs in white robes on white horses simply stole it." Others said that the abominable snow snake had gulped it.

The men who fly Kelly's Awful Airline are full of such stories. But that's a Navy characteristic. So, too, are guts and skill. The scientists who are squeezing facts out of man's last geographical frontier have been successful, in part, because they count on VX-6, and VX-6 stands behind its motto: "You Call, We Haul"—be it on record runs or short heroic hops. ★★★

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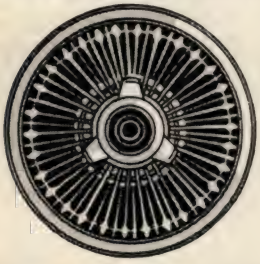

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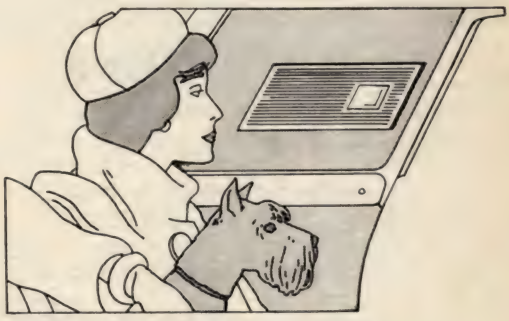

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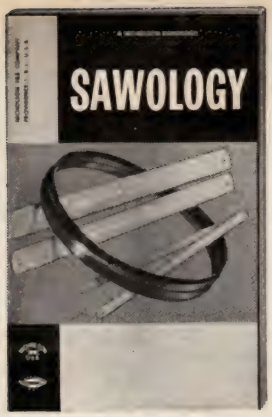

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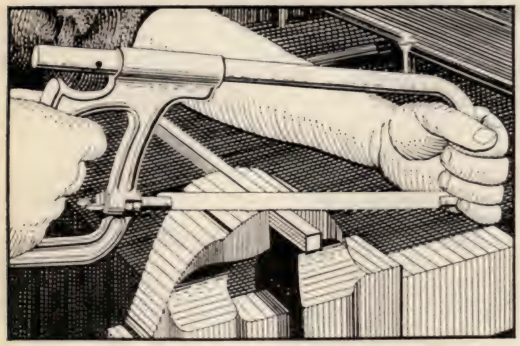

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Flying Catamaran

(Continued from page 139

hicle like this has good seakeeping qualities while on the surface.

But getting a large craft like this up into the air is a real chore and calls for considerable power in addition to the assistance of retractable skis or retractable hydrofoils. Weiland estimates that four to five times more power is required for takeoff than is needed for cruise. He would use 200,000 horsepower for takeoff, developed by 10 large gas turbines that drive large diameter propellers, then shut down most of the powerplants and retract them into the wings after takeoff. Initial cost, and estimates of operating costs, look good in spite of the power that rides deadhead.

No Bounce from Wood "Waves"

Recently Weiland joined with a large West Coast air-space manufacturer and a full investigation of his concept was launched. Wind-tunnel tests and computer studies were made, and they looked good. Several models of the tandem-wing craft were built, the largest being a seven-foot free-flight model. It weighs five pounds and is powered by a tiny .049-cu. in. gas engine that spins a 4½-inch propeller.

In the still air of a hangar the model flies beautifully in straight lines or in wide circles depending on control settings. It remains remarkably stable, even in gusts that are created artificially. It travels at a speed of 10 m.p.h., flying on its surface-effect cushion at an altitude of four inches. When it overflies a series of one-inch tall wood strips laid on the floor to simulate wave tops it shows little tendency to follow the wave pattern.

The next step was to build a large prototype. This test vehicle had a length of 52 feet and a span of 31 feet. Construction was mainly of plywood. The flying catamaran was powered with two 260-hp. engines in a nacelle above each hull. Each spun a three-bladed variable-pitch propeller. With a gross weight of 9500 lbs., the craft was designed to lift off at about 60 knots (with the aid of skis), cruise at 80 knots, and clear four-foot waves.

Prototype Crashes

Last March, at the Salton Sea in California, the craft made its first—and last—flight. Motion pictures from a helicopter show the flying catamaran rising up on its skis, then smoothly leaving the water and flying close to the surface. Then the pictures show the craft tilting up and climbing 25 feet or more, well above its surface effect altitude. It mushed downward when

(Please turn to page 208)

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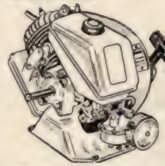

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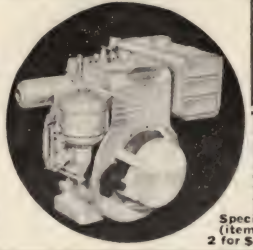
Special (item 106a)

$29.75

2 for $58.90
6 for $175.50

$69.95 5¾ hp. Briggs & Stratton



Briggs & Stratton 5¾ hp, Mdl. 143302. Re-coil start. Std. 1" shaft w. keyway, and adjustable governor — a rugged big engine ready to tackle any job.
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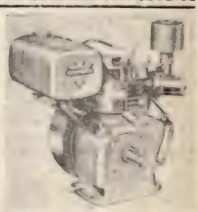

Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—⅝" std. shaft
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Flying Catamaran

(Continued from page 206)

the pilot chopped the throttle and crashed into the water, breaking apart.

What went wrong? The principal involved all have different ideas. But in this case, unfortunately, the company budget was used up and no more money was available for another one.

Meanwhile a different air-space company, Lockheed Aircraft, has been studying the same dynamic ground-effect phenomenon in a different way. Lockheed's "flying motorboat" consists of a 13-foot hull that supports a 16-foot wing with a deep pontoon at each end. The craft is essentially a trimaran instead of a catamaran. It is powered by a 50-hp. outboard and reaches an air cushion speed of 45 knots, almost 50 percent faster than the speed it can make without the wing.

The stability problem is solved at present by a pair of hydroskis that project down from the hull's bow. At times these are in the water. The propeller, of course, remains in the water at all times, thus the craft is a water vehicle instead of a true aircraft. Whether additional progress was made by Lockheed isn't known. The research was performed for the Bureau of Ships under a contract containing security clauses by the Navy.

And there it stands. Weiland has been stymied by an exhausted budget. Lockheed may or may not have made progress. But aviation engineers have solved innumerable problems of design and control in the past, and the stability bugaboo that is holding up the development of the flying catamaran may yet yield to their talents.

★★★

Navy Spy Spotter

Evasive action to keep a ship from being spotted by enemy "spy" satellites is being developed by the Navy. The system—an electronic computer and display screen—enables a ship or submarine to predict where an orbiting satellite will pass over the earth. If a sub, she can submerge; if a surface vessel, she moves elsewhere.

The system, still in the early development stages, is called SPAD, an outgrowth of the Navy's SPASUR system, the "fence" across the southern part of the nation which detects silent satellites. Computers will use the information developed by SPASUR to predict when satellites will pass near a ship's area. This information is automatically projected on a map so the ship may maneuver to avoid detection.

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Grinding Your Own Gemstones

(Continued from page 153)

to build up a conical shaped mass until this covers almost the entire flat side of the stone. It will require some practice to make a strong joint that will not break away from the stone while grinding. Let the wax harden fully before starting to grind the stone.

A stone mounted on a dop stick is much easier to control than an unmounted stone. Use your left hand as a fulcrum for the dop stick while manipulating it with the right hand. On curved surfaces the stone must be kept in constant motion while it is in contact with the wheel in order to avoid the formation of flats. Carefully shape the stone and grind the girdle, so it will fit a ring or other jewelry mounting you have selected, or to fit one of the holes of a standard ring template. Such mountings and templates are available at lapidary supply houses. The girdle should be about 1/16-in. wide. Grind a slight chamfer along the back edge. This helps to prevent a stone from chipping along its edge from accidental impact. Grind a half oval stone to the desired curvature being careful to get the shape symmetrical in both directions. Grinding should be done with very little pressure.

Wash Stone After Grinding

After grinding, wash the stone and dop stick carefully to remove all traces of silicon-carbide granules. Then start sanding on a 220-grit disc placed against a thin sponge-rubber disc which is in turn placed against the grinding wheel. Sanding removes the scratches made by the grinding wheel. It can be done either wet or dry. Avoid heating the stone by prolonged contact with the disc. Dipping the stone in cold water frequently will help to prevent this and will prevent the sealing wax from softening and allowing the stone to loosen. Remember this also when polishing. When finished, wash the stone and dop stick again and then do some final sanding on a 400-grit disc which will remove the minute scratches made by the first sanding.

Polishing is the last step. A canvas polishing wheel can be made by soaking the canvas so that it can be pressed over the edge of the plywood disc and then tied taut with two turns of chalkline. Cut off the surplus canvas beyond the tying cord. Make a thin paste of polishing powder and water and apply some of it to the wheel with a brush. Most effective polishing takes place just when the paste on the wheel starts to dry. ★ ★ ★

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For Sale
TOOL ROOM SURPLUS PRECISION LATHE, 3 x 6.9" cap., machines hard metals; all materials chuck, drive, built-in motor, precision chuck, cross feed, tool post, tailstock, 9-spd. accuracy; tool post, drill chuck, operating manual; post tor inst. conversion to sensitive vertical drill press, also use as vert. mil and surface grinding machine. ONLY $139.50. Call Ed Smith after 9 . . .
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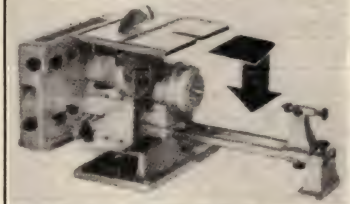

Multi-Matic 8 is a radically new breakthrough in power tool design. At upper left you see a Multi-Matic 8 running in the horizontal position. You have a powerful *8-inch circular saw*. Next to it ready to use instantly is a *belt sander*. On the right is a *9 x 36" wood lathe*. Built into the head is a *saber saw* and *fast cutting jig saw*. Either sets up in seconds. On any job, you *flip a switch* to select high or low speed.

Swing the frame up as the arrows show. Effortless and it takes only seconds. Your band saw now operates, or you can use the *7-inch* disc sander, *the molder*, the *horizontal drill*, and the *power grinder*. Yet the complete Multi-Matic 8 stores in less than 4 square feet. No workshop space is too small and no woodworking job too big! Multi-Matic 8 is portable too. With motor built in, wired and ready to run, price is only $269.50.

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Whispering Engine

(Continued from page 120)

two alternators for a total of 3000 watts. The dual alternator-generator set-up also would be used in an actual space unit.

Like the Army's model, the Allison space job used a conventional heat source for its 1000-hour test. In space it would more likely use solar energy. Sun heat could be collected in a large reflector that would focus on an absorber from which it would be pumped down to the heater atop the Stirling's cylinder. A lithium-hydride heat reservoir in the heater circuit could keep power flowing when the satellite was hidden from the sun's rays.

Adapting the basic Philips design to space presented Allison with a clutch of special problems. For instance, hydrogen —the usual working gas—actually diffuses through metal at high temperature. There's neither room nor weight to spare for a reservoir in a spacecraft, so designers switched to helium. It doesn't do quite as good a job, but it respects the sanctity of steel and works well enough.

Or Run It Backward

Such a power plant would function much longer than batteries and should be a far better electricity source than solar cells.

But there's yet another side to the Stirling thermal engine. Suppose you attach an electric motor to the crankshaft and turn off the heater. Soon, running the rhombic drive in the usual direction, heater coils will frost over as the entire heater assembly chills. Now turn the heater back on and reverse that electric drive motor. In a few moments the "cooling coils" will radiate heat. In short, the Stirling is just as good a heat pump as it is a heat engine. At least one industrial refrigerator—built by Philips—uses this feature. So don't be surprised if, one of these days, the rig that keeps your beer cold turns out to be a first cousin to a whisper-silent front-line power plant. ★★★

Free-Loading Lights

Ground lights to warn low-flying aircraft away from high-voltage power lines in remote areas may soon be powered by a unique electrical system—one which has no visible means of support.

Called the Free Loader, the system will have no line connection with a power source. Instead, it will take low-voltage power from the electrostatic field surrounding the high-voltage line to power flashing lights suspended between transmission towers. Free Loader was developed by the U.S. Bureau of Reclamation.

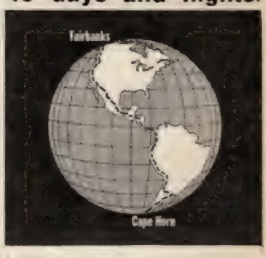
Comet roars from bottom to top of world to show it's still World's Durability Champion

Leaving Cape Horn Sept. 12, Comets slogged through spring mud. Later, cars tortured their suspension systems jouncing over 18-inch-deep ruts carved by trucks.

Despite rough going, these '65 Comets needed no major repairs during run.

Tres Arroyos, Argentina: one of the fine roads along the route the Comets took.

'65 "showroom" models make the historic 16,200-mile push in 40 days and nights.



Why did we do it? To show that Comet "can do." Last year, specially equipped Comets racked up 100,000 miles and the World's Durability Championship at Daytona. Now regular production '65 Comets have shown they're just as tough. We wanted to make sure you knew that. Now it's your move.

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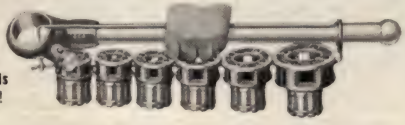

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*3¾"	16½"	1⅜"	24"	30 lbs $18.50
4⅞"	7¼"	2"	22"	30 lbs $22.75

New Hydraulic Snow Plow kit has D.A. Cyl. 1½"x8" stroke pump .410 cu. in. 1500 PSI 4 way valve, tank, hose & fittings $43.50.

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Modelmaker's Metal Lathe

(Continued from page 188)

the second face and O. D. of the pulley steps, then turn the belt grooves.

Two additional three-step pulleys will be needed for the motor and the idler to increase speed selection. Make these from 1½ or 2-in. round stock (steel, aluminum or brass) and cut three steps, allowing ⅜ to ⅝ in. between steps. Drill a hole in one to fit the motor shaft, the other to fit the idler bearing. Drill a #7 hole in the groove of the middle step for a locking setscrew.

The compound rest has to have a gib to take up play in the dovetail. This is simply a 2-in. strip of ⅛-in. flat steel that's filed to a 30-degree angle along its two edges to fit one side of the dovetail. Locate the four adjusting screws on the gib and spot-drill to a depth of 1/16 in. These dimpled holes keep the gib from shifting.

Thumbscrews for locking the tailstock to the ways, as well as the spindle in the tailstock, are made from ¼-20 x 1-in. brass screws with the heads cut off. Wing nuts are peened to the ends of the screws after first turning a ⅛ x ⅜-in. tenon at one end.

There's a Blank for Faceplate

The kit of castings includes a blank for making your own faceplate. Start by drilling a hole in the center and treading with a ½-20 tap. Follow by mounting the work on a threaded arbor, like you did with the spindle pulley, and turn the blank to the dimensions given. The two slots are cut in the edges by drilling 5/16-in. holes and then hacksawing in from the edge.

To make a campanion lathe dog to fit the faceplate, center-drill both ends of a 2-in. length of ¾-in. round stock and turn to a 5/16 in. O. D. for a distance of 1¼ in. Reverse the work between centers and turn chamfers on the ¾ in. O. D. portion of the turning. After forming two flats on opposite sides of the chamfered hub with a hacksaw or file, drill a 7/16-in. hole through it crosswise and file a square corner in one side of the hole as detailed. Follow by drilling and tapping a hole in the end for a ¼-20 setscrew. Complete the dog by placing the end of the turning in a vise and bending it 90 degrees to fit the faceplate grooves.

Now you're ready to assemble the parts. Insert the drill-rod ways in the headstock and lock with the setscrews. Slide the carriage on the ways and fit the support casting over the ends. If the carriage is tight and difficult to move, remove it and enlarge the rear way hole with an expansive reamer until the carriage slides without binding. When satisfied, remove the way support and slide on the tail-

stock. If it doesn't slide freely, do the same with the rear way hole in it.

Now remove the way support so the lead screw can be inserted in the carriage, reassemble and add the handwheel to the end of the lead screw. Mount the assembly on a hardwood base, driving wood screws through holes in ¾-in. wood spacer blocks. Note that the way support should be mounted at the very end of the board so there's room for turning the handwheel freely. Do not "twist" the assembly in fastening it down; where this happens, use shims to level it. Assemble the compound rest and cross slide with gib in place, and add the tool holder.

Now with the motor belted to the idler pulley and from there to the spindle pulley, insert the tailstock spindle in the headstock to cut the Browne and Sharpe #2 taper. This is done by running the nut (borrowed from the headstock spindle) against the thread shoulder, passing the spindle through the headstock and turning it into the three-step pulley. Add oil to the oilhole and let the motor run for a few minutes. Grind a long ¼-in. tool bit to reach into the spindle 1 in. and clamp it in the holder. Adjust the compound rest to cut a ½-in.-per-ft. taper, and make it with a series of light cuts. The finished diameter at the start of the taper should be .300, plus or minus .020 in.

Now remove the tailstock spindle and shorten it to 2⅝ in. Repeat the steps to taper the headstock spindle. Note here, however, that there is no extra threaded portion to cut off.

Turn the 60-degree points on the head and tailstock centers by swinging the compound rest around past center to feed the tool bit into the work properly. Finally, mount the faceplate on the spindle and check the compound rest for alignment. When aligned properly, scribe a witness mark on the 1⅞-in. hub. Other important angles should be noted and marked on the hub at the same time. Your lathe is now completed. ★★★

Salt Plus Heat Equals Trouble

Cars parked in heated garages suffer greater damage from salt and other deicing chemicals than those parked in the cold, according to tests that were carried out by various government agencies in Ontario, Canada.

Further tests revealed little benefit from the use of inhibitors, which, it was found, don't eliminate all corrosion; they only retard the type of corrosion caused by salting. The report concluded that corrosion can best be controlled by the automotive manufacturers themselves.

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Because they're fishermen themselves, West Bend engineers know what fishermen want in an outboard motor. They've designed a new 9 h.p. outboard *especially for fishermen.* It's *light* — only 55 lbs.; *compact* — takes up 10% less trunk space than low silhouette models; *economical* — runs longer on less fuel. See it today at your dealer's (listed in the yellow pages) or write for full color brochure showing all West Bend outboards — 3½ to 80 h.p. It's *free.*

Total Quality

TOP TO PROP

West Bend®

DEPT. 1441, ENGINE DIVISION
THE WEST BEND COMPANY
Hartford, Wisconsin

Control Your Car's Distributor

(Continued from page 178)

alignment. We said at the end of last month's article that it's not absolutely necessary to check point gap with the newer type points on the market, because they're pre-set at the factory. True, but to be really safe, don't skimp the check—something might have happened since.

Take a feeler gauge and make sure of point gap as shown on page 177. If this gap must be adjusted, do it by setting the non-movable point only. Don't touch the movable one. You'll really fine-tune the points later when testing for dwell.

Point alignment is most essential to good tuneup. Points must strike each other squarely to realize the full benefit of good spark and to insure maximum point life. Misalignment causes fast wear, overheating and pitting.

Turn the cam so the points are closed and check their alignment by sight, as sketched on page 177. If out of line, get them back square by bending the stationary arm with a point alignment tool which you can buy from a parts outlet for about $2. Do not bend the movable point, which has been structurally strengthened and could be seriously weakened if bent.

With the points set up, lightly coat the cam with a layer of cam lubricant. This is essential, since the cam lobes can wear badly because of lack of grease. When this happens, the gap between the points gets smaller, resulting in arcing, burning and pitting.

Finally, inspect the rotor and distributor cap for carbon marks and corrosion. If the rotor is the least bit out of condition, replace it. Run a wire brush inside the distributor cap towers to clean it out.

On-Car Distributor Checks

With the distributor back on the car and everything hooked up, you must check dwell (or cam) angle and timing to complete the tuneup. Many mysterious ignition problems can be traced to incorrect cam angle. And you can't correct this trouble just by adjusting point gap.

For example, suppose the points have been in use awhile and suddenly you develop an engine miss at high speed. You deduce, quite correctly, that the cam angle is too small, and you set point gap to correct specifications with a feeler gauge. But see what can happen, in the inset at the top of page 177.

Your gauge might show the correct gap of .020 in., but because of point wear the points are actually .030 in. apart. Thus, they now are opened too much, and you'll be wondering why the engine runs rough and the miss is as bad as it was before.

When resetting points that have been in use for awhile, you must test with a dwell meter and tachometer. Even when checking new points, it's wise to use these instruments for on-the-button tuning.

What is dwell? It's simply the number of degrees through which the distributor cam rotates while the breaker points are closed. Let's take an example. During one complete revolution of the distributor shaft, the cam rotates 360 degrees. In a six cylinder car, the cam is hexagonal, so in each revolution the points go through six cycles of opening and closing. If we divide 360 by 6, we find that for each of these cycles the cam rotates through 60 degrees.

Suppose our car is set up to have the points open for 24 of those 60 degrees. This means that the points are closed for 36 degrees. Thus, our angle of dwell is 36 degrees. The dwell angle, then, determines the length of time current flows through the primary winding of the coil.

When Dwell Angle Is Off

If the dwell angle is too small—if the points are set with a wide gap—the points open too slowly, causing excessive arcing and burning. They don't stay closed long enough to allow the coil time for full saturation. The result is an engine that misses at high speed.

If the angle is too large—if the points are set with a small gap—the points are closed and opened with a hammerlike action. This causes point bounce and erratic coil action. In addition, the coil and condenser don't get a chance to discharge completely. This leads to rough engine operation at low speeds, missing at high speeds, and burned and battered points.

To establish proper dwell for your car, you must have the manufacturer's specifications, since these differ from distributor to distributor. Generally, though, after the hookups of both dwell meter and tachometer are made as indicated on page 178, you accelerate slowly from idle to 2000 r.p.m., then drop back to idle. The dwell reading over this range shouldn't —in most cases—vary more than three degrees. If it's above or below this, you adjust the points accordingly.

However, there are exceptions. Some Auto-Lite and Ford distributors, for example, have a pivoted-type breaker plate, with the pivot off-center in relation to the cam. Any rotary movement of the plate by the vacuum advance can cause a big change in point opening and a corresponding change in dwell. On some models this variation could be as much as 12 degrees and would still be within specifications.

(Please turn to page 217)

CHEVY-VAN DELIVERS ALL SORTS OF THINGS AT LOW COST

It has a low price tag, and it's built to work a long time and go easy on upkeep. The big body, with 211 cu. ft. of load space and flat floor, carries a full ton of cargo. Sturdy welded construction is thoroughly rustproofed. Side doors are available if needed. So is the powerful Chevrolet 230 Six, now offered for the first time in Chevy-Van. It's a lot of truck for the money, from big one-piece windshield up front to big easy-loading doors at the rear. See how nicely Chevy-Van suits the sort of things you deliver—at your Chevrolet dealer's.

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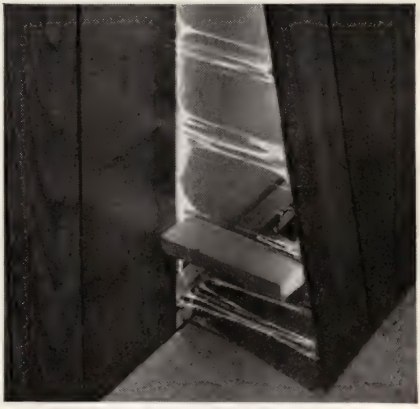
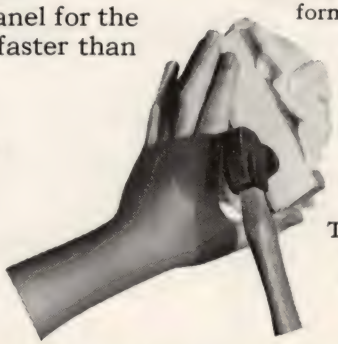


Drive 2 or 3 small finishing nails to form "hinge" at top to hold panel in position. Hand-press panel against adhesive. Then swing panel bottom edge 8″-10″ from wall. Hold out with space block. After 8-10 minutes, reposition panel against wall and align accurately. Tap lightly against soft wood block to make full-surface contact. That's all there is to it.



Send for free new Weldwood Glue Chart. Hang this chart in your workshop and take the guesswork out of gluework. Tells you the right adhesive to use for just about every gluing job.

Control Your Car's Distributor

(Continued from page 214)

You see now why you need full data on your distributor before running this test.

Finally, ignition must be timed, which is a basic operation that affects an engine's fuel octane requirements, as well as its overall performance and economy. Improper timing leads to shortened spark plug life, pre-ignition and a general letdown in engine performance.

We described the stroboscopic timing procedure at the start of this article. But we didn't say how to correct an "offset" condition, which means your spark plugs are firing early or late. The cure is quite simple: Moving the entire distributor housing right or left changes the position of the rubbing block in relationship to the cam lobes it rides on. This, in turn, causes the points to open earlier or later in relation to piston location.

Other Jobs for a Timing Light

Besides timing, which is done at engine idle speed, a timing light can also be used to check centrifugal and vacuum advance. As you slowly increase engine speed to about 1500 r.p.m. (using your tachometer), the timing mark should move in the opposite direction to engine rotation, as shown in the sketch on page 178. Note about how much this movement is. Now, disconnect the vacuum line to the distributor and again increase engine speed to around 1500 r.p.m. The timing mark should still move, but not as far as the first time. Since you've disconnected the vacuum advance, this second test shows centrifugal advance only.

Think you're done? Not quite. A road test is vital after completing a tuneup. For best results, operate the car in high gear at a minimum road speed (about 8 to 10 miles an hour). Then suddenly kick the accelerator pedal all the way to the floor. If the engine picks up smoothly and evenly, you're OK. In some cases, though, you may have to make a slight adjustment in timing if acceleration is anything but smooth or if you hear a "ping" emitting from beneath the hood.

In concentrating on the distributor, here, we've had to skip over other aspects of the ignition system. Take spark plugs, for example. Plugs are a separate story in themselves—in fact, that's our *Saturday Mechanic* piece for next month. ★★★

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What's on Your Mind?

(Continued from page 89)

If memory consists of such "marked" molecules, one aspect of the storage problem would be solved: there is ample space for them in the brain's hundred billion nerve cells. We know very little about how and where our records are stored, however, except that they are probably not stored in any single center. Large areas of the brain may be damaged beyond healing or removed surgically without causing measurable memory loss, suggesting that memory traces may be duplicated over and over again and stored in many places. No one knows how the duplication is accomplished, but the process is something like making copies of valuable documents and then keeping them in widely scattered strongboxes as a safeguard against fire and theft.

Gone, But Not Forgotten

Sometimes, of course, it seems as if the scattering is almost too effective and we fail to find the records. Notice that forgetting is *not* involved in cases like those of Glenn Davis and Mickey Walker. Strictly speaking, they had nothing to forget because they had formed no new traces. As a rule, genuine forgetting implies that we cannot get at memories that presumably exist intact somewhere. Perhaps nerve pathways are blocked and, if we knew how, we might be able to restore the past in full simply by using the proper drugs.

Another unsolved puzzle is how we recall information once it has been registered. Again, there is no special "recollecting" center, although certain areas of the brain seem to play a role. Wilder Penfield, director of the Montreal Neurological Institute and one of the world's foremost brain surgeons, stimulated points on the sides of the exposed brain by touching them lightly with a wire electrode or electrical contact. Since the brain feels no pain, operations may be conducted with a local anesthetic only, and patients are fully conscious and capable of describing their reactions.

One of Penfield's famous cases was that of a 26-year-old secretary. The instant he stimulated a certain point on the side of her brain, she heard an orchestra playing the song "Marching Along Together." Furthermore, it was not a "silent" memory, the kind of experience you have when you merely think of a tune. The woman felt as if she were living a double existence. She imagined she was sitting in an auditorium with all the individual instruments playing loud and clear, though at the same time she knew that she was actually in an operating room. She was vividly reliving a previously forgotten event. When the Canadian surgeon moved the electrode away, breaking the contact, the music stopped as suddenly as if an "Off" button had been pushed.

But the most unusual thing happened when the same point on the brain was stimulated again. The woman immediately heard the same music, but it did not continue from where it had stopped. The entire song started all over again from the very beginning—and the same thing happened for 20 successive stimulations. It was as if the memory were stored on a cerebral sound track, a tape that automatically rewound itself after every use in preparation for the next playback.

Penfield's comment on this and other similar cases: "It is the thread of time that has run through each succeeding wakeful hour of the individual's past life. Think of this thread as a pathway which can be followed again. . . . As long as the electrode is held in place, the experience of a former day goes forward. We have found a way of activating the anatomical record of the stream of consciousness."

But recollection involves far more than retrieving information in its original form. We can rearrange and classify the information with the speed of thought—and that represents perhaps the greatest mystery of all. Indeed, some of the things we do so routinely that we take them for granted are among the most baffling phenomena known to science.

Who Was That Lady . . . .?

For example, think of what must go on inside your head when this kind of question is put to you: "Did you ever see a movie called *Love Begins at Forty?*" Or a question like this: "Do you know Evelyn Mayo?" Think of how many movies you've seen and how many different people you've met and worked with and read about. Yet your brain contains a filing system of some sort, an impressively efficient system since you can come up with an answer (usually the correct one) within a few seconds.

There is also a searching system that usually works so swiftly that we are not aware of it. But its nature may be guessed at by considering what happens when we fail to recall something right off; for example, when we have trouble answering the question, "What was the name of that motel you stayed in last summer?" A common procedure is to run through the letters of the alphabet and decide that the name starts with a particular letter or combination of letters. Then you run through a list of words that meet those specifications. The odds are that something

of this sort is happening when you answer a question "without thinking," only the search proceeds at a fantastic speed.

Investigators in many fields would like to know how recall works—biologists interested in the complex operations of nerve-cell networks, psychiatrists whose job it is to treat memory disorders or to uncover buried memories and, most recently, engineers responsible for designing improved information-storing devices for computers.

Nature continues to set standards that we try to match. A host of currently unsolvable scientific problems could be unraveled if thinking machines remembered and recalled as efficiently as the human brain. ★★★

Shark's Ears Tuned to Swimmers

Using underwater sound signals as bait and a light plane for tracking, Dr. Warren J. Wisby of the University of Miami's Institute of Marine Sciences has fished out facts on the shark's remarkable ability to find food—including swimmers—quickly and accurately in the vast ocean.

He found, in about 20 shark-tracking missions which he and his associates carried out, that sharks can detect and locate the source of sounds more than 200 yards away. This follows an earlier discovery that a struggling fish or swimmer generates a "dinner bell" sound wave to the hungry shark. These bursts of sound, which can travel through the water a mile a second, are easily within the hearing range of the shark.

Dr. Wisby believes that sharks use the lower part of their hearing range, from about 7.5 to 100 cycles per second for hunting (sharks can hear up to about 400 cps). All common types of sharks, as well as other killer-fish such as barracudas, jacks and groupers, have been attracted by the signals.

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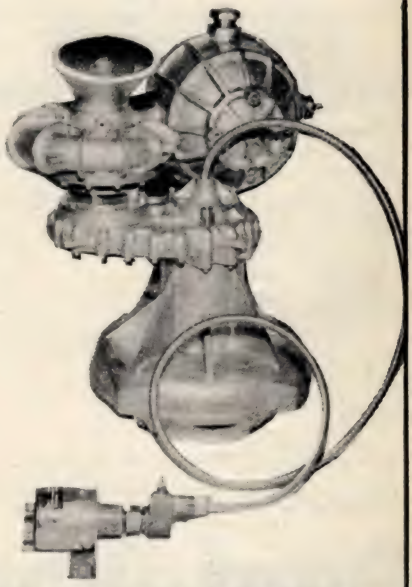

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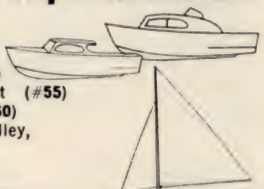

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Wallpapering Made Easy

(Continued from page 158)

lapping is important. Trying to cut wallpaper to fit exactly between ceiling and baseboard, and smack into a corner, could throw the whole job out of whack.

● *Pasting and Hanging*—Apply paste with a brush to the back of the first strip, covering it fully and completely, especially at edges. The paste should be mixed to the consistency of light cream.

After applying the paste, fold wet side to wet side toward the center of the paper so the top and bottom almost butt together. Without creasing the paper, carry it over to the wall. Start at the ceiling, peel open the folded end and hang the strip, running one edge down the plumbed line, and overlapping at ceiling, baseboard and corner.

● *Smoothing and Trimming*—Use a smoothing brush as a squeegee and firmly smooth the paper into place, being careful to remove all air pockets. Air pockets can be located by running your hand over the paper and feeling for lifted areas. At the corner, pound the paper in with the brush bristles until it fits tightly.

Several Ways to Trim

To trim the excess from the ceiling and baseboard lines, crease the paper with the back of a pair of shears, pull the paper away from the wall, cut along the crease and re-smooth. If you prefer to use a cutting wheel or a knife, keep them sharp or they'll tear the paper. If you use a razor blade, keep a supply of fresh ones on hand. A blade can generally cut only one or two edges before getting too dull.

Incidentally, if you plan to run a border strip along the top, you can be a little less careful when trimming the top of each strip of paper.

Once you're satisfied that the all-important first strip is properly smoothed and aligned, you can cut the succeeding strips. Start by matching up the pattern on the uncut paper with that of the strip already in place, and cutting off at the bottom, about two inches below the baseboard line. With some patterns, this will mean wasting a foot or more of paper on the second strip, but that is unavoidable.

Now, before hanging the second strip, match it up with the roll and cut a third strip and perhaps a fourth. Apply paste to these strips, folding from the ends to the center as before. Pre-pasting in this manner gives the paper time to absorb the paste and shrink to size. Continue to hang the second strip, matching the design of the second strip with that of the first that's already hung.

As you apply succeeding strips of paper,

make sure you butt the joints instead of overlapping. To get a tight joint, simply push the edges together with the palms then roll them with a seam roller.

Don't skip areas, such as around doors and windows, intending to come back to them later. Hang continuously, smoothing and trimming around door and window casings as you go along. Otherwise, you'll get a mismatched, patchwork effect.

As you come to a corner, let the wallpaper fall naturally unless it overlaps the corner on the adjacent wall by more than two inches. If it does, cut the paper along the corner crease and push the paper on both sides of the cut tightly into the corner. Wallpaper that extends beyond a corner more than two inches could buckle. If a strip falls exactly into a corner, provide a ¼-in. overlap when you hang the first strip on the adjoining wall—unless you're using a plain paper with no pattern to match.

● *Washing*—As each strip of paper is hung, take a sponge saturated in plain water and wash the strip down, soaking *thoroughly* over its entire surface. Do not use a rag, as it may abrade the surface of the paper. This washing removes marks and excess paste, and prevents the paper from wrinkling as it dries. While you're at it, examine the ceiling and baseboard and wash off whatever excess paste you find there with a damp sponge.

If paper "bubbles" after it's been applied, it signifies that air's trapped beneath or you missed a spot with the paste. You can remove bubbles by slitting them with a razor blade (page 156), soaking the area with water, working paste beneath the paper with an eyedropper, and pressing the paper back into place.

Dormers a Special Problem

Incidentally, a word about papering the inside walls of a dormer. It's almost impossible to match-up a pattern at the compound angle where the walls of the dormer and the slanting walls of the attic meet. To solve this problem, you can either use a plain or non-matching type paper, or use a pattern type, but cover the edges of the walls that form the compound angle by placing a strip of border trim along each edge. ★★★

Navy men at the South Pole Station have financially adopted an Italian orphan, and to raise money for his support they sell water. But not ordinary water is this. It's guaranteed to be more than 100 years old. They get it by scooping snow and ice from deep within the polar ice cap and melting it. The water is sold for a dollar a bottle to visitors.

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New Gadgets for Ice Fishing

(Continued from page 131)

ter, Inc., 411 Washington Ave., Minneapolis, Minn., seems to be extremely popular, and in the hands of a skilled operator can go through three feet of ice in less than a minute. This auger with an eight-inch blade costs $19.95.

The Norwegian Mustad auger is exactly like the Swedish auger except for the cutting edge, which is not a *smooth* curve, but a series of straight cutting edges. A six-inch model costs $13.95 and an eight-inch size sells for $18.95 from Worth Co., Stevens Point, Wis. It costs about $2.50 to have a Swedish or Norwegian auger sharpened.

A power auger is expensive, but most of these units double for other duties. The Hoffco Power Auger (Richmond, Ind.) sells for $134.95, but it will go through four feet of ice in seconds, and it also drills post holes. The newest power auger is made by Polaris Power Pole, Inc., West Hanover, Mass.; it weighs only 16 pounds and with an eight-inch ice bit costs $109.90. This unit also has a multitude of attachments that turn it into a snow blower, grass trimmer, hedge clipper, a pump, and it can even be used as an outboard motor.

Most ice fishing is done in less than 25 feet of water. I talked with a lot of ice fishermen up in Wisconsin's jack pine country, and on fishing method they pretty much agreed with Ronnie McKee.

Minnows Are Best Bait

"Mostly you're after walleyed or northern pike," Ronnie said. "Of course, you'll find a lot of people also fishing for bluegills; and the crappies will go as high as a pound or more. Well, anyway, the best bait for pike is a minnow. You'll find some people using lures, but I'd say that 90 percent will be using minnows. You start off by fishing about a foot off the bottom. You just lower the bait to the bottom and then raise it a foot. If you don't have any luck, you can bring it a bit higher.

"For bluegills and crappies you'll find more people using tiny jigs, and you fish near the surface with the jig moving."

An ice fishing jig is about a quarter inch long. Like most lures, there are dozens of varieties, but the two that were mentioned by almost everyone I spoke with were the black ant jig and the hackled spoon. All of the jigs have a No. 10 or No. 12 hook.

Now you get into ice sticks, ice rods and tipups. Local regulations may determine what you will use. In Minnesota, for instance, the tipup is illegal. There are also varying regulations governing the number of holes that can be fished (two in Wisconsin and Minnesota), the season and limit on certain species. These regulations are available at any tackle shop.

An ice stick is simply a round wooden stick about 18 inches long with a four-inch metal point (like an ice pick) on one end. In the middle of the stick, protruding about an inch, are two dowels about six inches apart. The line is wrapped around these dowels and threaded through a small screw eye about an inch from the bottom of the stick. This device, which sells from 50 cents to $1, is jammed into the ice next to the hole and the baited line simply dangles in the water.

To keep the bait moving (jigging) an ice fishing rod is used. This is a small and inexpensive (from about 80 cents to $3.50) glass rod that ranges in length from two to three feet, and is fitted with two or three guides. A reel can be used, but it is not necessary. These rods have a flexible tip, and the fisherman uses slow wrist action to keep it moving up and down. A unique mechanical device for jigging is new on the market. It consists of a weighted rocker that is swung back and forth by a simple rotary motor running off two flashlight batteries. This mechanism is inside a polystyrene container for insulation against the cold. A small arm extends from the side of the container from which two steel wire arms extend a foot to either side. The unit is placed in the ice between two holes, the lines from two ice sticks are draped over the hooked ends of the wire arms, and as the rocker moves the extended arm back and forth, the wire moves the baited hook up and down. Called Herb's Electric Jig, it is made by H. Baumgart Co., 1604 N. 9th Ave., Melrose Park, Ill., and it sells for $3.99.

Bite Makes It Flip

A tipup is basically a device that holds the line extended through the ice hole, and when a fish takes the bait a signal is triggered to alert the fisherman. This can be a section of thin sapling with a branch extending from each side. Most fishermen, however, find it more convenient to use a commercial tipup.

A type made of wood is inexpensive (about $1.25 to $2) and the most popular. It looks like a wooden cross with the upright suspended through the ice hole and the cross piece supporting it. On the bottom of the upright is a reel that looks like a pulley wheel and holds the line. At the top of the upright is a piece of thin spring wire about a foot long with a small flag on the end. This wire is doubled over and secured by a trigger (like setting a mouse trap), and a loop of line from the reel is attached to the trigger. A bite on the line

(Please turn to page 224)

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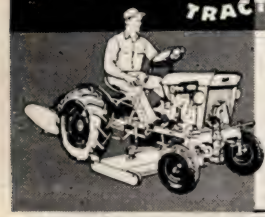

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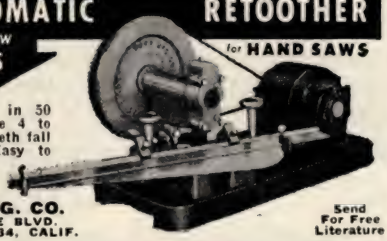

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New Gadgets for Ice Fishing

(Continued from page 222)

triggers the wire and springs the flag.

There are variations on this basic design. The Arnold Tackle Co. of Paw Paw, Mich., has a model made of metal with a tripod stand for $4, and for $2 extra it is equipped with a small red light that goes on when the flag is triggered. The Swede-O-Matic tipup offered by Finnysports, 2910 Glanzman Rd., Toledo, Ohio, incorporates a small compressed-air chamber that keeps the bait bobbing at three to four strokes a minute and creates air bubbles in the water to attract fish. It sells for $9.30. There is another called the Bite-Flag (509 James St., Turtle Creek, Pa.) that clips onto a regular fishing rod, and the flag is tripped when the line goes taut. It sells for $1.25. A more elaborate tipup is the Beacon Boy. This is a steel hoop with a hinged plexiglass lid that fits over the ice hole. A rod running across the hoop holds the reel over the hole. On the outside is a metal rod on a spring with a red light on top. The rod is bent over and held by a trigger. A tug on the line sends the light upright, which activates a pair of flashlight batteries inside the hoop to turn it on. R & R Products, 2317 Seminole Rd., Waukegan, Ill., markets this device for $9.95.

The only other piece of equipment necessary for actual fishing is a bait bucket, and it should always be polystyrene to keep the bait from freezing. Monofilament line and expanded plastic bobbers are also used for the same reason.

Tin Can Unfreezer

And on the subject of freezing, Ronnie McKee gave me a labor-saving tip that is used in the north country. After a day of fishing he takes a tin can that is opened at one end and fits it into the fishing hole. It will freeze solid overnight, but when he returns the next day, he just pours some kerosene into the can and sets it afire. He can lift the can out in less than a minute and he doesn't have to drill a new hole.

Comfort equipment makes up the bulk of ice fishing gear. The surplus Korean boot is almost impossible to find these days, but the new commercial insulated boots, such as those made by Red Ball or the Bristol Mfg. Co. or United States Rubber, are much lighter on the feet and are warm at 30 below zero. They range in price from about $16.95 to $19.95.

The ice fishing shanty is not a necessity, but it does add to the comfort. A shanty can be any size or shape, four pieces of plywood banged together with a plywood roof, or as elaborate as one I was told about by a Minneapolis fisherman that has four rooms with gas heat and wall-to-wall carpeting. A recent innovation is the ice fishing tent, which has a hole in the floor for fishing and an opening for a stove pipe. Hoosier Tents, 1302 W. Washington St., Indianapolis, Ind., has one that is five feet square and five feet high and is priced between $12 and $15. A two-man tent that is six feet by four feet and six feet high is available from Finnysports for $47.88.

A shanty is a necessity for spearing fish. With his multi-tined spear, the spear fisherman sits poised over his ice hole in complete darkness, so he can see down into the water and spot a northern pike passing within striking distance. A trick often used by spearers is to lay a large piece of metal foil on the bottom below their hole. This has the effect of turning a spotlight on the water below them.

You Can Stay Warm, Too

Heaters are naturally important to ice fishing, and there seems to be no end of them, from charcoal grills to propane radiant heaters. Inside a shelter it is important to select a heater that does not give off fumes and even then, make certain there is ample ventilation. We looked into several heaters and found them excellent for ice fishing on the basis of warmth, economy and safety. The Coleman Sportster ($10.95) is small and efficient. It can be used for cooking and with a heater drum ($1.88) it will heat a shelter all day on one filling.

The Whamo-Flameless heater ($12.99) burns ordinary camp stove fuel without a flame, giving off 2400 B.T.U.s. The Seater-Heater ($15.90) burns wood alcohol, is also flameless, has an adjustable heat dial, and you can sit on it for added warmth. The Sterno Porta-heater is the cheapest ($4.88) and is only four and a half inches by five inches wide and 15 inches tall.

A unique aspect of ice fishing that is practiced primarily on the East Coast is eeling. Using a trident with hooked tines that has a handle about 20 feet long, the eeler probes the mud at the bottom of lake or pond where the eels burrow.

Newest ice fishing craze is the fishing derby. Usually a one-day affair, a derby offers prizes to the ice fisherman who catches the most or the largest fish within a certain time limit. It is estimated that there will be about 500 fishing derbies in the Great Lakes states this year. The fad began at the 1947 St. Paul, Minn. Snow Carnival, and if you need further proof of the spread of this sub-zero madness, last year's Tip-up Town Festival on Lake Houghton, Mich., drew a record crowd of 25,000 fishermen. ★★★

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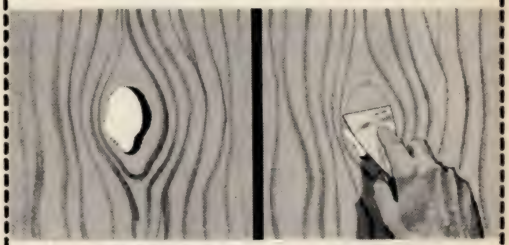

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Servicing the '65 Cars

(Continued from page 111)

a wider and flatter cross section, is supposed to last longer. And it may give owners of older cars a break; with larger inventories to worry about, retailers may have to cut prices on conventional sizes.

Beating the Scallops

Uneven tire wear has been a problem on some late cars. A common pattern is uniform scalloping of the shoulders of one or both front tires. Tire makers blame over-soft suspensions; Detroit blames the tires; and mechanics blame misalignment or imbalance. Manufacturers of wheel-alignment equipment have a fourth whipping boy—incorrect steering geometry. One such manufacturer has published instructions for bending pitman arms and idler arms (we predict car makers will take a dim view of this).

Sometimes the problem can be cured with heavy-duty shocks and stiffer rubber bushings in the front suspension. Other cases respond to a change in tire brand. We won't cast any stones yet, but, significantly, a couple of car manufacturers have quietly announced redesigned steering linkage—to reduce tire wear.

New suspensions also call for revised servicing. Corvair, for example, now has an articulating-link rear suspension, much like Corvette's. Specified toe-in remains at ⅛ to ⅜ inch. To adjust, loosen the bolts in the slotted front bracket of the torque arm and slide the arm sideways. Index marks on the bracket line up with a pointer on the underbody, making adjustments easy. On '65 Corvairs, camber can be adjusted by an eccentric washer and bolt at the outboard end of the rear strut rod.

Wheel alignment is also easy on new Fords. Shims are replaced by serrated upper control-arm shafts. For more negative camber, loosen the front bolt and move the front portion of the upper arm inboard. Increase or decrease camber by moving the entire upper arm and shaft outboard or inboard. The serrations bite in to hold the proper setting.

The Fight Against Rust

You'll be replacing fewer cancerous body panels on the '65s. There's an increasing trend toward the use of galvanized metal. In large Chevs, water entering the cowl air intake flows into the rocker panels, flushing out accumulated dirt. Part of the incoming cowl air is diverted to dry the rocker panels. Full-size Fords now have front-fender splash shields.

A big change in most Ford and GM makes is the switch to perimeter frames. With fewer body mounts, the Ford frame soaks up bumps before they reach passengers' tender backsides. The body, in turn, is more rigid. Ride is softer and quieter, but it remains to be seen whether more rattles and squeaks develop.

Ford engines have a new positive-crankcase-ventilation valve containing a jiggle pin similar to last year's Chrysler design. Manifold vacuum keeps the pin hopping, preventing clogging deposits. Don't clean the valve; replace it every 12,000 miles. Ford isn't advertising the fact the whole troublesome PCV system was replaced on most of their engines last year by the old-fashioned road-draft tube—except in California and New York, where PCV is required by law.

Chevrolet has reinstalled the drain plug in Powerglide transmissions and recommends draining and refilling every 12,000 miles.

Warranties will remain unchanged until factories get a better idea of the cost of extending them. Most maintenance recommendations have been carried over. ★★★

Golfer's Tricycle

Starting with the frame of a girl's bicycle, a Florida golfer has put together a three-wheeler that transports him and his clubs across the course.

Mike Walters of Sarasota welded together scrap metal to make an A-frame at the rear and a rack for his golf clubs. An extra-large sprocket drives the rear wheels, making it easier to pedal up slopes.

Walters estimates that it cost him about $40 to build the man-sized tricycle.

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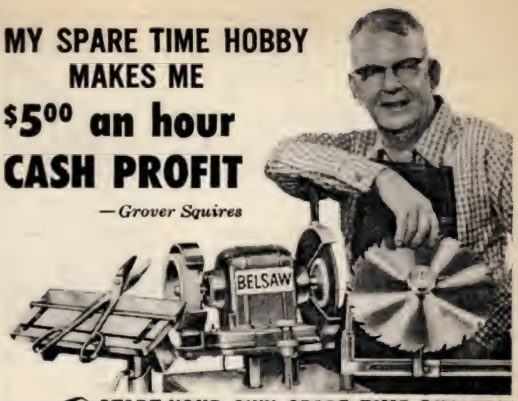

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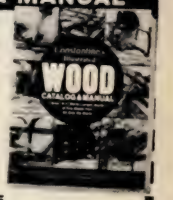

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Test-Matching Three Hot Ones

(Continued from page 94)

stock Corvairs was a rather sudden and unwholesome switch from understeer to oversteer." Now the camber change during full wheel travel is about half what it was. And wheel camber reduces oversteer by reducing tire adhesion in a bend.

Slalom tests (see drawing, page 92)—A row of five pylons was spaced along the straight; we zigzagged through for a fast turnaround and twisting dash back to the gate. It was meant to repay a quick steering ratio and a system that tells you what's happening where the wheels meet the road.

Times were close: The Corsa 23.2 seconds; Mustang 23.4; Barracuda 24.5.

"The car is sound," Fitch said after the Mustang run. "It's solid and well balanced for its size and weight." The Barracuda's power steering is faster than the Mustang's manual gear (18.1:1 to 22:1), but twice the 'Cuda engine faltered at the turnaround and "power assist fell off completely," John reported. "You notice we made the end turn with the Mustang in a single curve; we couldn't do that in the Barracuda." While the Mustang suspension held the car relatively flat, the Barracuda thrashed and wallowed. "Coming back to the starting gate, I had to aim for the pylons and hope we'd fishtail through," Fitch said.

(A quick manual steering ratio is on the way for Barracuda; it should help.)

The Corsa "didn't show any power, really," John commented, yet it produced the best slalom times of the day. The independent rear let speed hold up, but throttle delay prevented much pick-up in the short space between each corner.

Acceleration tests—As expected, the bigger, higher-revving, higher-powered Mustang engine and its low-geared rear axle won all the marbles in the acceleration tests (see p. 92). Even with its automatic transmission, the Barracuda put up a good show in dead-ahead running. Speeds weren't high enough for the Corsa's turbocharger to help. The boost delay also hurt on passing-speed tests.

To the Back Country—For a general-use check of the cars, we left the track and toured back roads with each one. Here are comments we got:

"*Barracuda* is the most spacious, comfortable highway car of the three, but as it stands now, its sportiest feature is still the low, hollow exhaust note. For non-sporting highway use—this car has a good bit of performance. Power and passing speed are there, although you have to push. Off smooth roads, the suspension seems a little uncontrolled and sloppy."

(Please turn to page 230)

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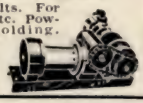

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Test-Matching Three Hot Ones

(Continued from page 228)

Mustang "The immediate sensation in the Mustang is one of stiff power—a rough, tough combat machine. Driver legroom is fine. Wind noise fairly strong. The car follows into reasonably sharp undulations smoothly and firmly, then quickly levels out in stable condition." On a steep, washboard-y gravel hill you have to feed gas with a delicate toe to keep from breaking loose. There's an even guttier axle available—4.11:1—maybe for towing trucks.

With all this power, the four-speed transmission seemed a waste of dollars. "You can do anything you want just using Second and Fourth," Fitch said.

Corvair Corsa. Fitch charged Corsa's delayed throttle response to "the unavoidable spookiness of the exhaust-restrictive design" in which exhaust gases drive the compressor to load the cylinders. But the new suspension charmed him. "I don't think you can call a design really sophisticated unless it has an independent suspension," he said, and the drawbacks of the old Corvair system have been attacked with the Corvette-ish rear links.

But Their Brakes. How well do those three cars stop? We made four stops with each car from 60 m.p.h., one every 30 seconds so each set of brakes had the same cooling time. Each was at the same hard rate—about 17½ ft/sec^2 by the Bennet-Feragen decelerometer—so demands on each system were the same. And *PM*'s Clark Pressometer told how required pedal force increased as heat affected linings.

While the pedal pressure required quadrupled in the Barracuda, it increased only 27 percent in the Mustang and 71 percent in the Corsa. Engineers see brakes as a device to change dynamic energy to heat energy—but you have to get rid of the heat robs linings of stopping ability.

Full Mileage Tests—On our caravan trip back to New York, we weren't shooting for economy-run figures, but we weren't charging down the highway either. So the Corsa's turbocharger got a rest—and its 164-cu.-in. Six showed up as economy champ. Even at 80 m.p.h., the manifold gauge showed negative pressure.

How's the final score? Here's how we see it: The Corsa provides nimble, lively action with a controllable drift on curves that's a true delight. The Mustang gives lots of brute power, generally well designed and organized. And without its complete battle-dress, Barracuda's strong points are good highway power, smooth road comfort and a look of action.

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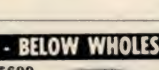

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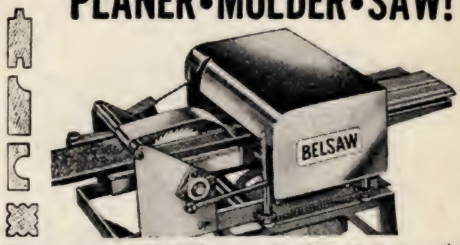

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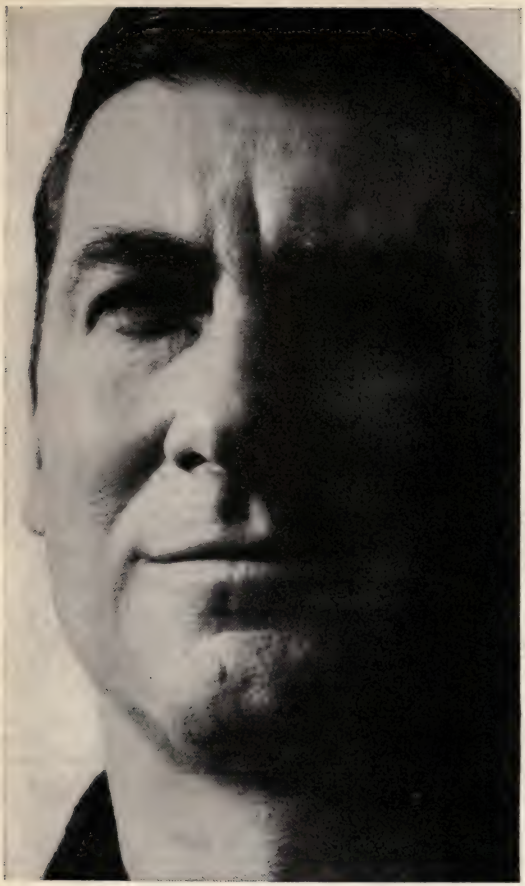

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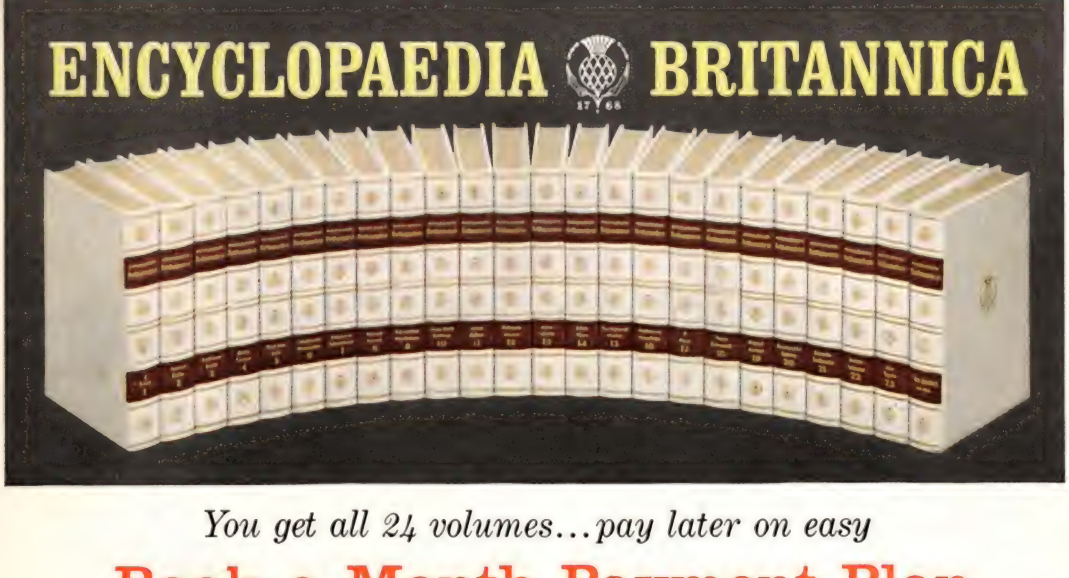

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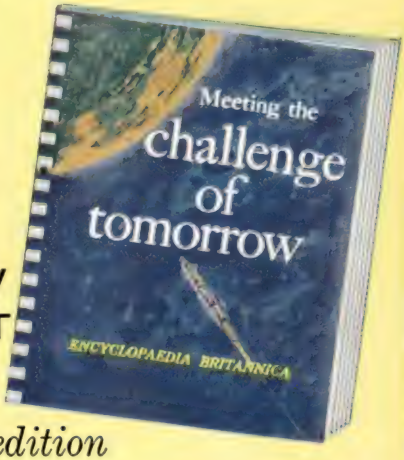

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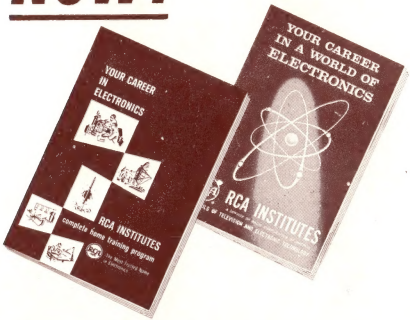

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